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PAVING SEWERAGE

MUNICIPAL ENGINEERING

WATERWORKS PARKS

A MONTHLY MAGAZINE.

DEVOTED TO THE IMPROVEMENT OF CITIES.

GOOD ROADS, STREET CONSTRUCTION,
CLEANING AND LIGHTING,
SANITATION,
BRIDGES.

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ASPHALT PAVEMENTS

THE BARBER ASPHALT PAVING COMPANY

BOWLING GREEN BUILDING
BROADWAY, NEW YORK

Highest Awards Received at World's Fair, 1893.

1st—ASPHALT AND ASPHALTIC CEMENTS:

"The Refined Asphalt and Asphaltic Cements for Pavements and Asphaltic Mastics are of excellent quality and up to the required standard. Tney are therefore worthy of an award."

2d—TRINIDAD ASPHALT PAVEMENTS:

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3d—MACHINERY AND PROCESSES:

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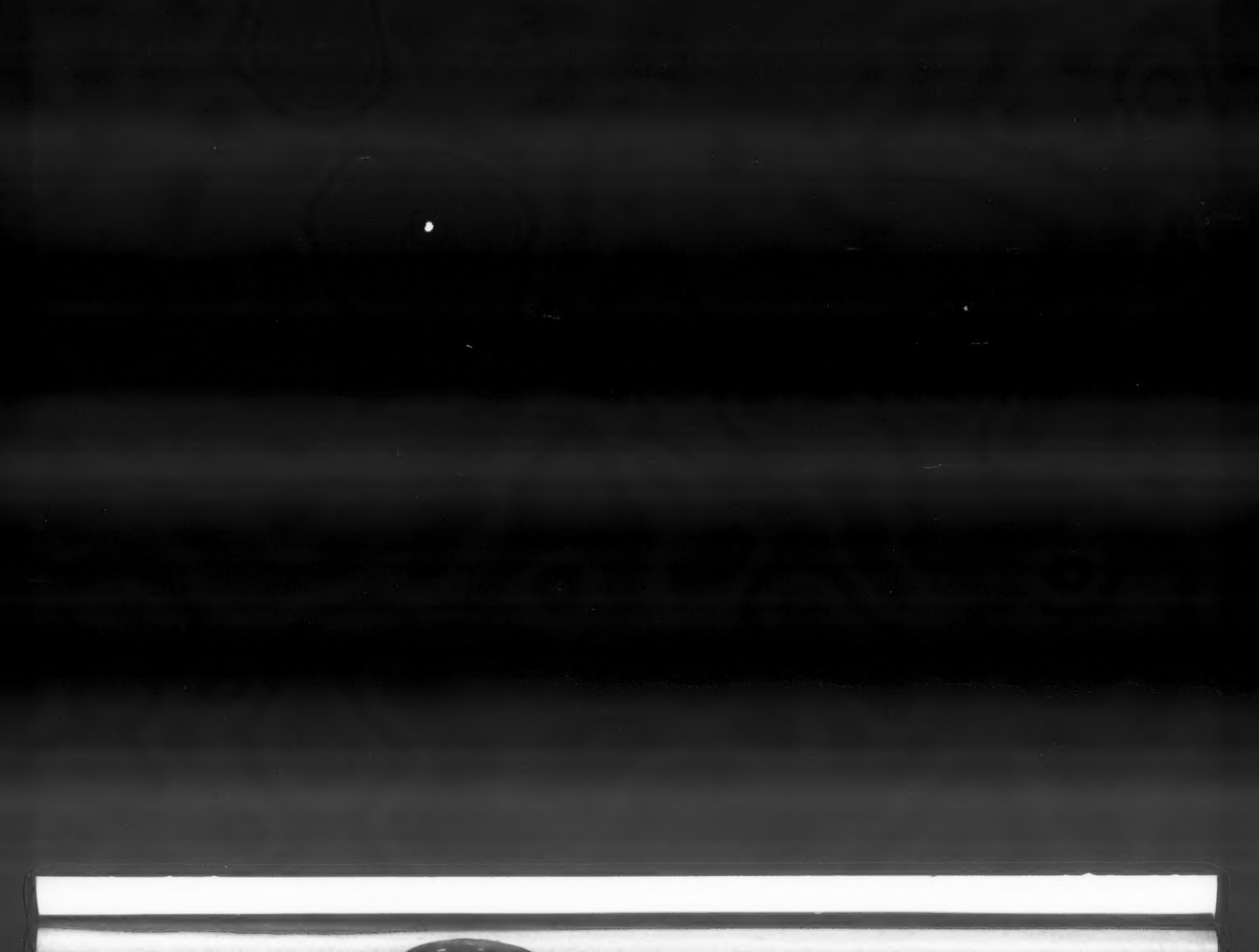

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Municipal Engineering

VOLUME XV. JULY, EIGHTEEN NINETY-EIGHT. NUMBER 1.

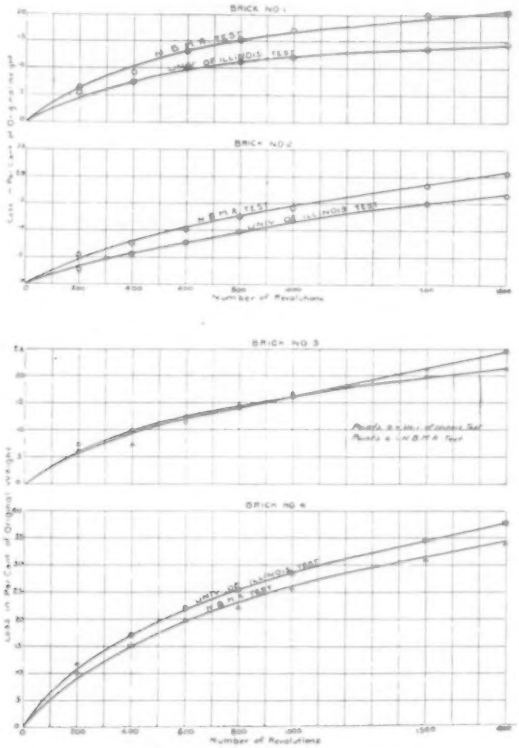
STANDARD PAVING BRICK TESTS.

By Charles Carroll Brown, M. Am. Soc. C. E.

At the last meeting of the Illinois Society of Civil Engineers and Surveyors, the Committee on Tests of Paving Brick presented a report which differed in some respects from the recommendations of the National Brick Manufacturers' Association. Professor A. N. Talbot, of Illinois State University, was the chairman of the committee. He thought at that time that it was possible the abrasion test recommended by the Association would not discriminate against soft brick with sufficient clearness. The use of foundry shot of definite dimensions is recommended by Professor Talbot, who considers the shot known as the University of Illinois Standard to be most satisfactory. This consists of cast iron blocks of two sizes, equal weights of the two sizes to be used in a charge. One size is 2½ x 3⅛ x 5¼ inches, weighing about 8 pounds, and the other size is 1x1½x2½ inches, weighing about 1 pound. Both have rounded edges, the larger with a radius of one-half inch. It is claimed that when a charge consists entirely of brick of one quality, with no harder material, soft brick will not act upon each other with any greater proportional force than hard brick act upon each other, so that when the bricks are weighed the amounts of loss in the two grades of brick will not differ materially, and the soft brick will attain to a standing in the table of tests nearly, or quite, equal to that of a brick which is materially harder. If the standard foundry shot is used we have a material of standard hardness, size and weight whose effect is presumably proportional to the softness of the brick.

In the *Technograph*, the annual publication of the Engineering Department of the University of Illinois, just issued, Professor Talbot presents a report of a series of tests intended to show the differences between the two methods. Four kinds of brick were selected, one an excellent repressed shale paver, the second a similar brick, the third a good surface-clay brick which in use has shown itself inferior to the two preceding, and the fourth a high grade sewer or building brick. Each kind of brick was put through the standard abrasion test of the N. B. M. A., with 15 per cent. of the rattler filled with brick, with a rattler 18 inches long and also with one 36 inches long, with 30 revolutions a minute. The diameter of the rattler was slightly below standard, being 24 inches. Each kind of brick was also tested by the proposed standard with 150 pounds of each size of shot de-

scribed above and 12 bricks for 36-inch length of rattler and half this amount for 18-inch length of rattler, and a speed of 20 revolutions a minute. The following diagrams show the resulting percentages of loss by the two methods after 200, 400, 600, 800, 1,000, 1,500 and 1,800 revolutions respectively:

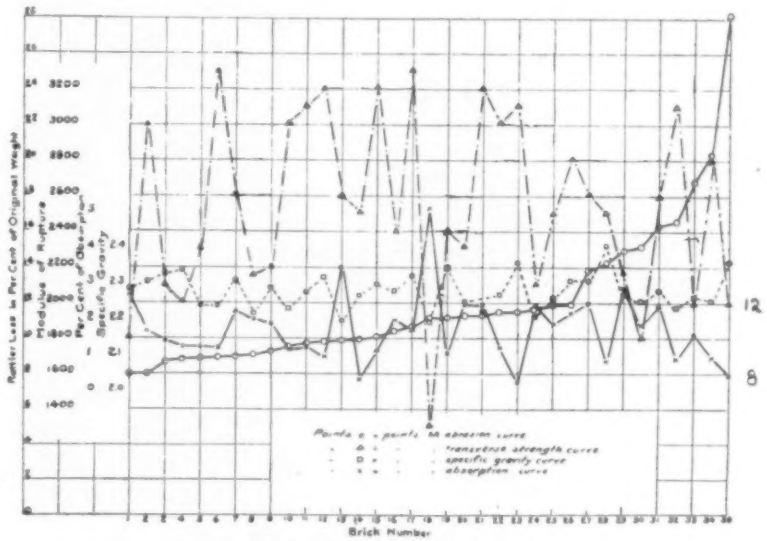


RATTLER LOSSES OF BRICK.

It will be seen that for the best brick, the N. B. M. A. test gives greater abrasion than the University of Illinois test, for the softer brick the curves cross, the N. B. M. A. test giving less abrasion for more than 1,000 revolutions, and for the sewer brick the N. B. M. A. test gives lower results throughout. The N. B. M. A. test makes bricks No. 1, No. 2 and No. 3 of equal value, although No. 3 is proven by use to be less durable than either of the others. The sewer brick shows a loss only about 12 per cent. greater than the others, in 1,800 revolutions. On the other hand, the University of Illinois test shows a sharp distinction between the various bricks, the percentages of loss being for bricks 1, 2, 3 and 4, respectively about 14, 16, 24 and 38 per cent. (1,800 revolutions). It is interesting to note that the results from the two methods correspond most closely in the case of the softer paving brick tested.

It should be noted that the number of kinds of brick tested is small, and that the number of individual bricks tested is comparatively small; also, that some of the conditions varied slightly from the N. B. M. A. standard. It can not be said, therefore, that the case against the adopted standard is fully made.

Enough evidence is presented to demonstrate the desirability of more extensive experiments along this line. If so slight a change in the standard method of testing as that proposed will increase the definiteness of the indications so much as is here shown, time and money spent in demonstrating it will be well spent. The N. B. M. A. test has the merit of ease of application, as no special apparatus is needed beyond what is easily found in any city likely to apply the test, while Professor Talbot's modification would require the preparation of the special blocks of iron proposed. If further experiment shows that the results here presented are not accidental, the value of the modification is much more than the slight trouble and expense of procuring the blocks would measure.



RESULTS OF TESTS OF PAVING BRICK.

Another interesting diagram in Professor Talbot's article is one giving the results of tests on thirty-five different brands of first-class brick from Ohio, Indiana, Illinois, Iowa and Missouri. In the diagram the results are arranged in the order of loss by abrasion. The diagram is interesting mainly because it shows the practical independence of the various tests. Professor Talbot thinks he sees a slight indication that the transverse strength decreases as the loss from abrasion increases, but if the results are arranged in the order of transverse strength, this indication practically disappears. There is no definite relation between specific gravity and either abrasion loss or transverse strength. The absorption seems to decrease slightly as the transverse strength increases, and there is a less positive indication that the absorption decreases as the abrasion loss increases. The indications of this diagram are therefore that each test must be made on its own merits and that a standard of rejection based on any one test will reject many bricks which stand high in other tests. The question of the advisability of restricting the tests to the one of abrasion as recommended is thus shown to be one the answer to which will depend upon the opinion of the individual

engineer regarding the indications of the various tests. A properly designed abrasion test should indicate the action of the brick under the impact and abrasion of actual use and on its face is the most valuable test, if not the only one of really practical importance. If absorption is excessive, frost might have a serious effect upon brick, but within the limits shown on the diagram this effect may be neglected. The abrasion test would probably reject the brick in case the absorption were excessive. Bricks properly laid in the pavement are not subjected to transverse strain nor is their crushing strength ever approached. The results in the diagram, if arranged in order of rate of absorption, will show that specific gravity decreases as absorption increases. For the class of brick tested this relation will not be so definite in general.

IMPROVED PORTLAND CEMENT.*

By John W. Dickinson, M. Wes. Soc. E.

A perfect Portland cement is a product consisting of an intimate mixture of lime and clay-bearing materials, with the elements in exact and perfect proportions and free from any deleterious or even adulterating substances, all burned to a perfect clinker and the clinker ground to an absolute flour. Should the raw materials, even if of perfect composition, not be in a finely divided state or not intimately mixed, the chemical union of the different elements which should be accomplished by heat, is impossible, and the resulting product is simply calcined clay or calcined lime and not unground Portland cement, as it should be, and it would be immaterial how finely such so-called clinker was ground, it could never be Portland cement.

Marked improvement has been made in the last few years in the preparation of the raw materials. Instead of going to the kilns in a coarse, unmixed condition and with the different elements varying from 3 to 5 per cent. as was the former practice, and unfortunately is today in many mills, such precision is used in the best mills, that the raw materials are brought to a condition approaching impalpability, then thoroughly mixed, and by the use of improved methods and competent supervision the proportions of the chemical elements, viz.: lime, silica and alumina, are so controlled that the variation never exceeds one-half of 1 per cent. Great advance has also been made in burning. Bear in mind that the lime and silica in a Portland cement must all be chemically combined by heat, and to effect this combination, a great heat is necessary when the fluxing elements, alumina and iron, are kept at their proper minimum, and no product of the kilns that has not been thoroughly cindered and consequently chemically combined should be used with the clinker making the finished cement, and it is safe to state that owing to the improved process of burning adopted in the past few years, the proportion of underburnt material coming from the kilns has been reduced from 25 per cent. to 30 per

* Abstract from paper read recently before the Western Society of Engineers.

cent., to less than 5 per cent., and in some cases the product of the kilns is invariably perfect clinker. The higher the percentage of combined lime the stronger the cement, and owing to the improved methods employed both in preparation of raw material and in burning, the lime has been increased from about 55 per cent. of the total to an average of 60 per cent., and in a few cases the entire process is so perfect that 65 per cent. of lime is successfully incorporated.

called cement represented by such residue is equally inert. Some investigators have reported slight strengths from the residue obtained by taking the intermediate of the 150 and 200 sieve, but I am positive that the strength thus obtained was wholly owing to the cement flour that adhered as dust to the coarse particles.

By improved grinding machinery 85 per cent. of flour is secured, instead of only 60 per cent., as was the case ten years ago. As adobe

ALEXANDER STREET, ROCHESTER, N. Y.

But it is probably in the matter of grinding that the greatest advance has been made. Perfect clinker is sufficiently hard to scratch glass, and it is evident to anyone that will take two pieces of clinker, say the size of large diamonds, and wet the surfaces, that on putting them together no bond will result. Now, if we break up one of these pieces and attempt to cement together even the smaller particles, we find that these are no more cement than the larger pieces. By taking the residue on the 50—100 and 200 sieve, it will be found that the so-

was superceded by lime, lime by natural cement, natural cement by Portland, so have the coarsely ground bicalcic-silicate Portlands of ten years ago been practically supplanted by the fine-ground tricalcic-silicate cements.

Cement work suffers more from careless and mischievous attacks during the first month than in any future twelve, so the quicker a cement sidewalk, floor, or foundation is hard and out of danger of attack from any source, the better, and it has been the aim of the American manufacturer to produce

a cement that will get its maximum strength in the shortest possible time.

Data were submitted showing the relative strength of an American and of imported Portland cements as determined by several engineers, and they showed in every case the marked superiority of the former.

In the lines of improvement may be mentioned:

1. Better preparation and more accurate mixing of the raw materials.

2. Uniform and complete incineration.

3. Fine grinding.

This country has taken the foremost position in Portland cement manufacture, equalling at least in the first particular any other country and in the second and third easily leading the world.

MANAGEMENT OF WATER-WORKS.

OUTLINE OF THE PROCEEDINGS AT THE ANNUAL CONVENTION OF THE AMERICAN WATER-WORKS ASSOCIATION.

The eighteenth annual meeting of the American Water-Works Association, held at Buffalo, June 14–16, was attended by over two hundred members and guests. It was one of the most interesting and pleasurable meetings in the history of the organization. The attendance was largely from the east, but many of the familiar faces from the west and south were there. The program embraced an unusual number of good papers and the local entertainment was most hospitable and generous, including trips about Buffalo, famous as one of the most attractive American cities, a visit to Niagara Falls, a trip to Syracuse, and kindly attentions in many ways from the Buffalo committee, of which Col. Francis G. Ward was the popular chairman. In appreciation of Col. Ward's efforts the delegates presented to him a handsome silver service. Addresses of welcome to the delegates were delivered by Hon. Conrad Diehle, mayor of Buffalo, Capt. M. N. Drake, M. J. Heeley, and M. Maher, commissioners of public works.

Mr. John Caulfield, of St. Paul, at the opening session, delivered his address as president, in the course of which he said:

Human society has, until our time, advanced with but tedious slowness along the paths which lead to the general well-being. Not until after a lapse of over twelve centuries, and even in a day that living men can recall, did the Christian world awake to the great truth that short of the teachings of the Divine Master Himself water was, and is, the greatest civilizing and refining influence brought to bear upon the lives and characters of men. The aqueducts of Greece and Rome, constructed only after centuries of barbaric destruction and decay had passed over the great canal waterways of ancient Egypt and Babylonia, did more than all the legions of the Cæsars, and more than the doctrines of half the sages of Greece, to make men see the divine possibilities of human existence.

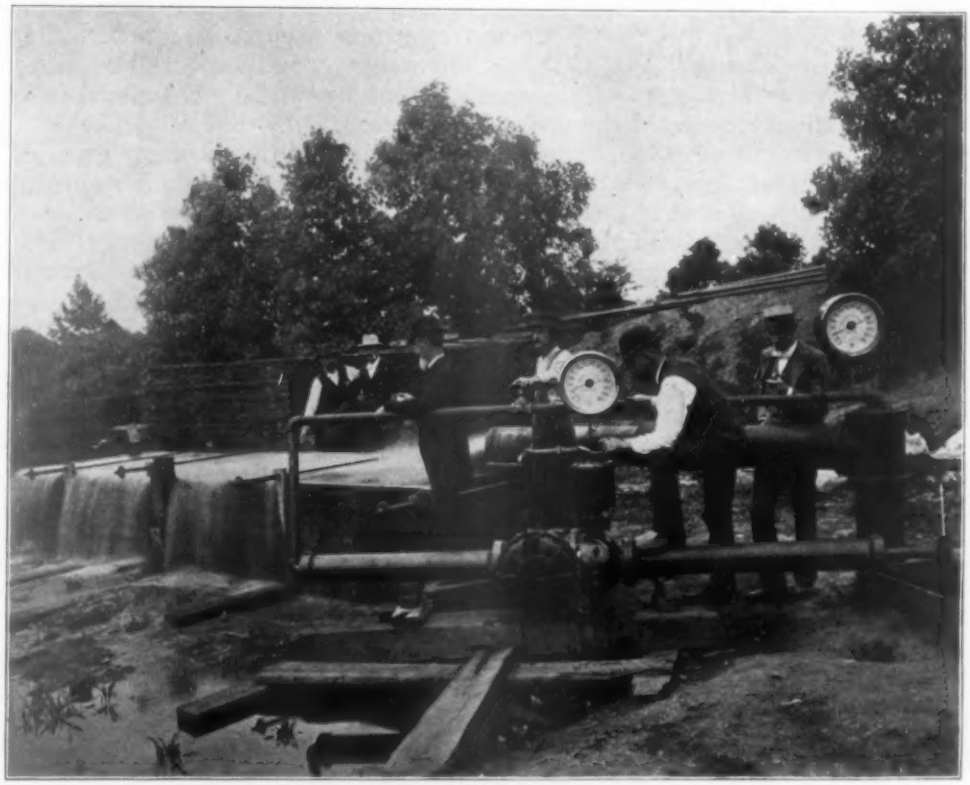
With their destruction and decay in turn, Roman civilization, like that of Egypt, perished from off the face of the earth, and mankind again, for generations untold, sunk to the level of the devouring beasts. And in the intervals between the destruction and the re-building of the means of conveying water to man's habitation, history in its every leaf shows that there was neither growth nor true intelligence.

However we choose to regard the work of providing an adequate and healthful water supply for the large centers of population, we must be impressed with its gravity. The security of life and property alike depend on how that work is done. In

the entire domain of municipal government there is no other department but becomes trivial by comparison. Financial interests may become disturbed and even perverted; the loss is but a mischance of business life. The ordinary duties of official life may be neglected; taxes may mount to undue proportions; the source of representative government, the ballot, may become for the time polluted; even the seat of public justice itself may become tainted. But the remedy for all this is in the hands of the people themselves, to

until every city in the United States shall have at its disposal at the minimum of cost, and with the least expenditure of effort, a supply of pure and wholesome water vastly more than adequate to every exigency of municipal life; and beyond all possibility of the presence or the introduction of the slightest taint that might in the least interfere with the public health or comfort.

When that day comes you will see an end forever of fire and pestilence wherever men congregate—those twin enemies of



LIFTING WATER FROM WELLS WITH AIR.

apply before enduring injury has been done. All these wrongs may right themselves—nay, they have from time to time become righted—and no man has been worse off in any of the great requirements to human happiness and private and public contentment.

But let the water supply of a great city become deranged or polluted, and catastrophy impends. Life and property are imperilled, if not destroyed, and the very end and aim of civilized society is defeated. The men who laid the foundations of this body built better than they knew. They did great service to every American community. Their work will not be done

civilization, against whose ravages human society had for centuries been engaged in a life and death struggle.

We must not expect to see this great end achieved without much trouble and disappointment. We are but the servants of the public and we are constantly to be confronted with the possibility of misunderstanding and suspicion on their part. In the delightful dispensations of partisan politics, those of us who can not soar to the lofty heights of local statesmanship are not unlikely, from time to time, to find ourselves edified by the jeers and threats of the men who understand, as we may not, all the secrets of municipal government, from the

ward caucus to the latest pronouncement of the judicial bench, but who know nothing whatever, and are incapable of learning anything of those vital interests which bring us together to-day in deliberative session. Doubtless many of you yourselves know how such things go. But we must be patient. Progressive as they are in their public, as in their private, concerns, the American people are slow to learn of their own advantage. But when they do learn, the lesson is not soon forgotten. Nor will it be long until they have thoroughly learned that the public man who will seek to bring the water department of a great city within the operations of party political strife, is a mere charletan, whose folly, if left unchecked, may develop into public crime.

The secretary reported the membership as numbering 355, embracing 286 active, 68 associate and 1 honorary.

The first paper was by Mr. F. A. W. Davis, of Indianapolis, under the title, "Some Information." It covered several subjects. His discussion of the financial reports of several cities is published in full in this number. He also referred to the decision of the Indiana Supreme Court, in the Fowler case, affecting the power of cities to buy water-works, and to some experiments relating to electrolysis. He also described the new reservoir of the Indianapolis Water Company, which is about 1,000 feet in length with an average width of about 50 feet. The covering consists of yellow pine boards 3½ ins. wide, resting on joists about 2 x 12 ins. The joists rest in turn on 6-in. wrought iron pipe, placed horizontally and supported by 4-in. cast iron pipes for columns.

Mr. Davis also made a statement of the result of tests in lifting water from wells with air. The well on which the tests were made was 10 inches in diameter, 330 ft. in depth, depth of water above the end of air pipe 64 ft. 4 in., outlet of discharge pipe above water in well 25 ft. 8 in., lift 25 ft. 8 in.; tank used, length 21 ft. 5 in., width 5 ft., depth 2 ft. 6 in., capacity 267 cu. ft., or 2,002.59 gallons; length of air line in well 90 ft., including 3 ft. of perforations, size of air line 2½ ins., air pressure on meter 36 lbs. Seventeen tests were made with a pressure varying from 35 to 47 lbs.: cubic feet of air used from 99 to 146 lbs., the time required to fill the tank varying from 1 minute and 35 seconds, to 3 minutes and 35 seconds. The short pipe gave the poorest results. The test by the 4-inch pipe was to ascertain if, by reducing the annular space in the 10-in., a greater flow of water would be obtained, but the results did not show it. In all of these tests the temperature varied only from one to two degrees at compressors and at well.

The temperature of water as it comes from the well is 54 degrees. The aeration of the water causes it to precipitate the iron rapidly. The air line was covered to the depth of about 1-16 of an inch in eight months' time.

Mr. William Himrod, of Erie, Pa., read a paper on the subject "Furnishing Water." It narrated many incidents connected with complaints regarding the quality of water at Erie, and gave an account of experiences with meters. Improvements and a large new cast iron intake pipe now give a satisfactory supply of water. The books of the water department of Erie are so kept that it can be known how each account stands at the close of each day.

Papers by Mr. W. R. Hill, C. E., of Syracuse, N. Y., on "Early Methods of Collecting, Storing and Distributing Water," and by Mr. John B. Heim, of Madison, Wis., on "Water Meters and Rates" are published in this number. In the discussions of the latter Mr. Jas. H. Harlow cited the instance of the

Wilkinsburg Water Co., which supplies a portion of Pittsburg and some outlying territory, showing that out of 1,000 metered customers, less than 65 per cent. use 6,800 cubic feet of water per year, which amount must be paid for whether used or not, and 10 per cent. used not over 2,800 cubic feet. He suggested 5,000 cubic feet a year as a proper basis for a minimum rate. About one-third of the meters failed each year until the company began filtering.

Mr. Hill said that in Syracuse, in 1897, there were 4,200 families whose total use of water did not exceed the minimum rate of 3,000 cubic feet per year, for $5.

Mr. P. D. Warner, of Reading, Pa., said that the tendency of the day seems to be first to filter and then to meter.

Mr. Gwinn, of Quincy, on the question of inefficient meters, said that his company used a 1-64 inch aperture for testing their accuracy.

In a paper on "Experience with Vegetable Growth in Ground Water," Mr. Owen T. Smith, of Freeport, Ill., described some experience with the crenothrix, an organism which forms in the suction pipes connected with driven wells, so that it can be pulled out in handfuls. The pipe is cleaned with a steel brush. It imparts a brown color to the water, and is said to be due to the sesquioxide of iron in the water. The water is exposed to neither light nor air before the growth takes place. The best advice that could be offered for a remedy was to find a water without iron.

Mr. S. A. Charles, of Lexington, Ky., read a paper on "Filtration and Aeration," which appears in this number.

Mr. S. E. Babcock, of Little Falls, N. Y., in a paper on "Compensating Reservoirs in Lieu of Compensation for Riparian Rights and its Legal Aspects," defined the rights of riparian owners in the water of running streams. In England it is common for authorities taking such water for public supply to build compensating reservoirs instead of paying damages to riparian owners. This practice is in accordance with an act of parliament. At Little Falls a compensating reservoir has also been built, and a large saving effected over what would probably have been fixed as damages under condemnation proceedings. This was done, however, under private contract, and after the city had bought some riparian rights and had obtained some advantage over the owner of the principal remaining one. Mr. Babcock presented figures of stream flow under maximum, average and minimum conditions, and also a line of argument designed to show that if only a sufficient storage capacity were provided to keep the stream up to its normal, dry weather capacity, riparian owners could demand no more. He also cited one American case where the court held that the diversion of flood water was not a ground for damages.

Mr. F. W. Cappelen, of Minneapolis, presented a report from the committee on pipe coatings, and on his recommendation the report on the same subject from a committee of the American Society of Municipal Improvements (published in full in MUNICIPAL ENGINEERING, November, 1897), was ordered to be included in the report of the proceedings of the association.

Mr. G. T. Latta, of Ludlow, Ky., described a method of which he is the inventor and patentee for introducing service pipes without

trenching, being a process of hydraulic tunneling on a small scale.

Papers on "Free Water for Private Baths," by Mr. L. N. Case, of Detroit; "An Oil Filter for Boiler Feed Water," by Mr. Dabney H. Maury, Jr., of Peoria; and on "Cleaning Reservoirs," by Mr. Dow R. Gwinn, of Quincy, Ill., are published in full in this number. Mr. W. H. Laing, of Racine, Wis., described a stand-pipe and its brick casing.

Mr. H. E. Keeler, of the National Tube Works, Chicago, read a paper on "Municipal Franchises." In the discussion, Mr. Milne pointed out that within the meaning of the law a franchise is tangible property, with a definite earning capacity, and its value can be accurately computed. He believed that when water-works companies are in difficulty they should employ engineering skill, by which means they will discover their weak points, and go before a board of arbitration on a firm foundation, which will assure a fair valuation. Mr. Gwinn said that usually an opportunity was not afforded for arbitration, but that the opposition generally commenced at once to promote a duplicate plant, which, of course, means confiscation. There is no legal protection against this in any state except Pennsylvania, where a municipality can not engage in the business of water supply without first purchasing the existing plant.

The election of officers occurred on the second day of the convention, in accordance with the change in the constitution, and resulted as follows:

President—J. A. Bond, chief engineer of the Wilmington, Del., water-works.

Vice-Presidents—W. R. Hill, chief engineer Syracuse water-works; C. P. Allen, chief engineer Denver Union Water Company; L. N. Case, superintendent and secretary of the Detroit water-works; R. M. Clayton, city engineer, Atlanta, Ga.; J. D. Heim, superintendent of the Madison water-works.

Secretary and Treasurer—Peter Milne, New York City.

Finance Committee—D. R. Gwinn, Quincy, Ill.; W. H. Laing, Racine, Wis.; F. G. Ward, Buffalo, N. Y.

The convention closed with the trip to Syracuse on Friday. The party were taken to Syracuse on a special train, and were shown the Syracuse water-works. The ladies were entertained at a dinner, reception, and musicale at the Kanatenah Club, and the gentlemen visited the Century club, afterward attending a banquet at the Yates, where they were welcomed by Mayor James K. McGuire. In the talk at the banquet Mr. Hill was given credit for the success of the gravity water system of Syracuse.

The next meeting of the association will be held at Columbus, O.

EXAMINATION OF FINANCIAL STATEMENT OF MUNICPAL WATER-WORKS.

By F. A. W. Davis, Vice-President and Manager Indianapolis Water Co.

Having occasion to examine the domestic rates charged in some of the principal cities of the various states, I found Buffalo, Detroit and Minneapolis were very low. An examination of their respective reports made it quite apparent that the cities mentioned have made a rate that will be difficult to maintain, yet they may do so. The results are given with the hope that some discussion may be had as to the actual value of the service rendered. The report of Detroit shows that their actual expenditures were

$397,448.04, less the reductions of $6,231.82, leaving net $391,216.22.

While making an estimate on the basis of these figures, it should be noted that one hundred thousand dollars of actual expenses was to pay off bonds. The report shows that their pumpage product was 12,928,821,326 gals.; the cost was $391,216.22. Dividing the $391,216.22 by 12,928,821,326, we find that the cost per 1,000 gallons is 3.026c. Referring to their meter rate, we find that over fifteen thousand gallons per month is, per thousand gallons, 1¼c. Yet the cost of producing water is shown as above, 3.026c. The entire pumpage, if sold at 1¼c per 1,000 gallons, their lowest rate, would produce $161,610.26. Allowing that the $100,000 used to pay off bonds was a profit, and deducting that sum from the $391,216.22, would leave $292,216.22. Making the same calculation as above, we find that the cost per thousand gallons is 2¼c.

In the domestic rates we find that for a 30-foot lot where hose is used, the charge is sixty cents a year. In the report of '96 we find a statement that it was shown by tests that sprinklers used from four to thirteen barrels of water per hour. The average would be about eight and a half barrels per hour; at forty gallons per barrel, would be three hundred and forty gallons. Estimating that the average sprinkler is used 1½ hours a day, we have 510 gallons per day. Six days in a week would be 3,060 gallons for the week. Counting four weeks to the month, this would give 12,240 gallons per month. This water at 5 cents a thousand gallons, highest rate, would be 61 cents a month; six months would be $3.66. It would, therefore, appear that 60 cents is inadequate for a service that is uniformly recognized as an abused and wasteful service. The charge to manufacturers for the same quantity of water would be $3.66. On what theory could we furnish water for sprinkling service for less than we furnish it to manufacturers and other users by meter measurement?

It is further noted that the estimated receipts for this year will be $227,395; taking the expenditures, $292,216.22, being the actual less the bonds paid off, there would be a deficit of $63,821.22. It seems, therefore, that it will be necessary to add to the amount of the tax levy, which was $74,831.01, the deficit of $63,821.22, making a total tax levy of $138,652.23.

It is expected to make the property-owners pay for extensions. However, there are connected with every department some extensions of lines, increase in size of mains and purchases of new machinery with which property-owners cannot be chargeable, and it seems that these requirements have to be provided for through a general tax, basing our statement on the figures given. This brings us to the proposition whether or not it is fair to levy a general tax, to give water consumers low rates. There is no question but that every city should levy a tax to be paid to the water department because of the general service, such as supplying water to put out fires, cleansing sewers and other uses of water for the public. What such services are worth requires some consideration. The city received $74,831.01 for water furnished as mentioned above. The city in this case does not furnish fire protection, but furnishes water for the fire department, which must be provided with steamers to do the work of putting out fires. If the tax for such purposes is largely increased, the question arises, are the water rates as low as they appear to be. A greatly increased general tax makes it hardly fair to the non-consumer of water. It is certainly manifestly unjust to the water takers to charge rates that produce sufficient revenue to support the whole department. On the other hand, it is hardly just to reduce rates so that the man who has non-productive property must be taxed higher in order to give the water consumer a very low rate. This same proposition seems especially unfair when the tax is based upon valuations. A man may have a very large residence and not be a large consumer of water, which is furnished at a low rate, but his general tax may make his rate high.

In the Buffalo report, 1896, not having the '97 report, we find that this city is supplying water at a low rate, and to make up a deficit that would occur in the water department, is levying a general tax to pay for hydrant service and other public uses. This city's report, 1896, shows that the city had a deficit of $525,164.07. To cover this deficit, bonds were issued. The new rate which has been established will make an estimated reduction of 30 per cent.

The gross receipts of 1896 were		$641,807 56
30 per cent. of this sum..		192,542 26
Leaves		$449,265 30
The salaries were .....$	126,379 87	
Fuel	92,258 56	
Interest on bonds.....	158,779 25	
Repairs and maintenance	57,471 40	
		$434,889 08
Leaving a balance of		$ 14,376 22

for extensions, alterations, repairs and new machinery. It would seem that this city will be obliged to levy a greater tax than

it has in the past for the requirements mentioned or increase the bonded indebtedness.

Their pumpage was 37,287,373,450 gallons, and estimating that it cost to produce the water $435,139.07, we find that the cost per thousand gallons is 1.166 cents and the lowest meter rate 2 cents.

The city of Minneapolis charges $1.30 per foot when the mains are laid, being 65 cents each side. There is also paid by tax levy the interest on the water debt. The cost of the works is given as $4,565,915. This sum at the rate of interest which is now being paid on the water bonds, $4.37, is $199,530 39
The operating expenses 99,809 99

Total cost $299,339 98

Taps in service, 14,349. Taking the above sum and applying to each tap makes the annual cost .....$ 20 86
The revenue received was..... 211,590 00
This applied to each tap would be... 14 74
Making a deficit per tap of..... 6 12

A house of five rooms is scheduled at $1.80 but it does not seem that this is the actual cost. To this we add the interest, 6 per cent. upon $19.50, the amount invested for pipe for a 30-foot lot, which is $1.17, making the cost $2.97, instead of $1.80.

The new ordinance of the city of Chicago assesses a frontage rate based upon the height and width of the property and for which rate certain water privileges are granted. The property not having water connections have a rebate of 50 per cent from the assessed rate. The street mains are paid for by the property-holders. The general rate of taxation in the city for all purposes, outside of an assessment for water, is $9.60 per $100. The asessed valuation may vary from one-fifth to one-eighth of the actual valuation.

It must be clearly understood that there is no disposition whatever to criticise the rates or business methods of cities named. The reductions and changes are such that the result will be noted with great interest, especially in view of the appreciation of the value of the water resulting from expensive purification methods that must be generally adopted.

There is no question but that just and equitable charges should be made to the city and citizens, but to arrive at them, direct and indirect charges should be taken into consideration.

EARLY METHODS OF COLLECTING, STORING AND DISTRIBUTING WATER.

By William R. Hill, C. E., Syracuse, N. Y.

Before attempting to review any of man's work in the art of collecting, storing and distributing water, it would be well humbly to bow to our Creator and acknowledge that all human contrivances are but faint imitations of nature's most wonderful and magnificent machinery. We find nature performing the duties of an immense hydraulic engine, requiring neither wheels, nor cranks, nor rods, nor pistons, continually converting water into vapor and pumping it into the atmosphere. In the night the dew gently settles over the surface of the earth and gives a sweet and refreshing drink to all the vegetable kingdom. At the dawn of day the sun's rays burst forth and silently and invisibly pump the water in perfect purity up to the distributing reservoirs, the clouds in the heavens, which are grand and beautiful in their formation, presenting the appearance of gigantic mountains crowned with snow, tinted with gold and silver, and emblematic of purity in their whiteness. At other times they present an angry aspect. They cast dark shadows over the earth and seem to be engaged in a great conflict, cannonading each other with electric fire, accompanied by vivid flashes of light followed by the loud reports of the discharge of their artillery. The winds distribute them in the heavens and affected by the temperature they fall in the form of rain, hail and snow to refresh the earth, to give drink to man, to give life to vegetation, and to form streams, lakes and rivers, the natural conduits that convey the water to the great storage reservoir, the ocean.

The subterranean boiler's water is heated by Pluto's blue sulphur flames, generating steam and producing power to operate nature's marvelous pumping machinery which discharges water from the bowels of the earth with a pressure sufficient to produce nature's amazing fountains, the geysers.

Water is purified by passing through natural filter beds, the subterranean strata of sand and gravel, and leading therefrom we find small service pipes conveying the clear, cold and sparkling water to nature's fonts, the springs. Every tree and every plant is performing the services of a pump drawing up the water from the ground through their

tubes to the top of the highest tree in the forest, even to the end of the smallest blade of grass in the meadow. * * *

The remains of aqueducts in many parts of the world give evidence that the ancients were well provided with water. The supply was generally discharged into fountains placed in different parts of the cities and then conveyed by the water carriers to the dwellings or to wherever it was to be used. The aqueducts of the Greeks were open or subterranean channels. They apparently never constructed any aqueduct bridges, hence they left no conspicuous monuments of their works. They were unlike the Romans, who performed work with a disdain to obstacles, building immense structures of masonry to conduct water across deep valleys. Many of the bridges still existing, though in ruins, excite our admiration and astonishment.

In the year 312 B. C. water was for the first time conveyed to Rome from a distance. At that time Appius Claudius the censor constructed the Aqua Appia aqueduct from the Alban mountains, a distance of eleven miles. The channel was underground the entire distance with the exception of about 100 yards. In the first century, at the time of Emperor Nero, Rome was supplied with water by nine aqueducts, the aggregate length of which was 255 miles, with a capacity of over 200,000,000 gallons per day. After the construction of other aqueducts the capacity was increased to about 375,000,000 gallons per day. At the time of Constantine there were in Rome 926 public baths, 247 reservoirs and 1,212 public fountains. Many of the fountains were rich in works of art and were of a monumental character, and were dedicated to some god who was supposed to keep the water pure and undefiled.

France had many notable aqueducts. In the first century, in the time of Emperor Claudius Caesar, there was constructed a conduit from Mount Pila to Lyons. It crossed thirteen valleys on aqueducts and three valleys by inverted syphons. The first syphon was laid in a valley about 2,600 feet wide and 217 feet deep. The second in a valley 3,458 feet wide and 325 feet deep. The third was of considerably less importance.

The water was admitted on the upper side of the first syphon into a reservoir of masonry, in walls of which were inserted, at about ten inches from the floor, nine lead pipes eight and three-quarter inches in diameter and one and one-twelfth inches in thickness. These pipes were carried down the side of the valley on a species of substructure, arched in some places so as to preserve a regular inclination; they were of the same diameter as at the commencement for a distance of eighty-one feet, and they then each divided into two pipes of six inches diameter. The eighteen smaller pipes were continued to the bottom of the syphon; but instead of descending quite to the lowest part of the valley they were carried across an irregular depression of the latter on an aqueduct of about eighty feet maximum height, so that in fact the descending limb of the syphon was only about 164 feet in vertical height and the ascending limb was about 142 feet. Midway in the ascending limb the two six-inch pipes were reunited into nine-inch ones, and the latter poured the waters they conveyed into a small reservoir corresponding with the one on the descending side. The descending limb of the second syphon was 282 feet.

The famous Bridge of Maintenon which was constructed in the seventeenth century, during the reign of Louis XIV., to convey water to Versailles is, without doubt, in point of magnitude and heighth, the most magnificent structure of the kind in the world. The bridge was about 4,400 feet long and over 200 feet high. It consisted of three tiers of arches, one above the other, of fifty-foot spans.

On the 29th day of September, 1613, water was for the first time conveyed to London from a distance. An open channel about eighteen feet wide and five feet deep was constructed from various springs near Ware and Amwell to the metropolis. Although the distance in a streight line was not more than twenty miles, yet the conduit by its circuitous route was forty miles in length. This length was preferred in order to obtain a fall of three inches per mile throughout its entire course. Later on the channel was shortened to a length of twenty-eight miles. The valleys were in most cases crossed by timber aqueducts, the water ways on which were lined with lead. These timber aqueducts were replaced with embankments about the year 1785.

The canal that supplies the city of Marseilles with water was constructed during the years 1839 to 1847. It is among the boldest undertakings of the kind in Europe in modern days. It has a capacity of 285,000,000 gallons per day. The water is conveyed about sixty miles through forty-five tunnels of an aggregate length of eight and one-half miles, and across many valleys by aqueducts, the largest of which, that over the ravine of the River Arc, is 1,287 feet long and 262 feet high.

Through small holes bored in the ground water is often raised above the surface by natural hydrostatic pressure. In Europe this mode of obtaining water was first practiced

in the French province of Artois, anciently called Artesium, hence the name artesian is derived. At Aire, in that province, there is a well from which the water has continued to flow steadily to a height of eleven feet above the ground for more than a century. There is a flowing artesian well within the old Carthusian convent at Lillers that has been in steady operation since the year 1126. Unmistakable traces of much more ancient bored wells appear in Asia Minor, Persia, China, Egypt and even in Sahara. At Grenello, in the vicinity of Paris, there is an artesian well which is 1,798 feet deep. It discharges water at the rate of about 850,000 gallons per day and at a temperature of 82 degrees Fahr. The boring of this well commenced in the year 1834 and was completed in the year 1841. Previous to the latter date no well had reached a depth of 1,000 feet. The well at Passy, near Paris, is 1,923 feet deep. At its bottom it is two feet and four inches in diameter. It throws a continuous stream of water, at the rate of about 5,500,000 gallons per day, to a height of about fifty feet above the ground. At Bourne, England, there is an artesian well ninety-five feet deep, which yields over half a million gallons per day, with a pressure sufficient to supply the town and to force the water to the tops of the highest houses.

The older cities of Germany were the first to use pumps to raise water for public purposes. There they were quite commonly used in the year 1550, operated by water wheels. We have no information in detail of their construction. Pumping engines were first used in London in the year 1582. Water was raised from the Thames river to an elevation of 120 feet by sixteen force pumps. The pumps were operated by two undershot water-wheels placed under the arches of the London bridge. The wheels were twenty feet in diameter and were turned by the current during the rise and fall of the tide. When the water flowed rapidly the wheels make six revolutions per minute. The plungers of the pumps were seven inches in diameter and had a stroke of thirty inches, and for every revolution of the wheels they made two and one-fifth strokes. The pumps had a total capacity of 2,500,000 gallons per day. About the year 1757 one of Newcomen's steam engines was erected to raise the water at ebb tide when the water-wheels were not in operation. A water company, incorporated in London in the year 1691 to supply water from the Thames river, used a Newcomen engine, but soon laid it aside and worked their pumps by horses. In earlier days the supply was obtained by the City Company of Water Bearers, who brought water from the adjacent river in leather panniers slung on the backs of horses.

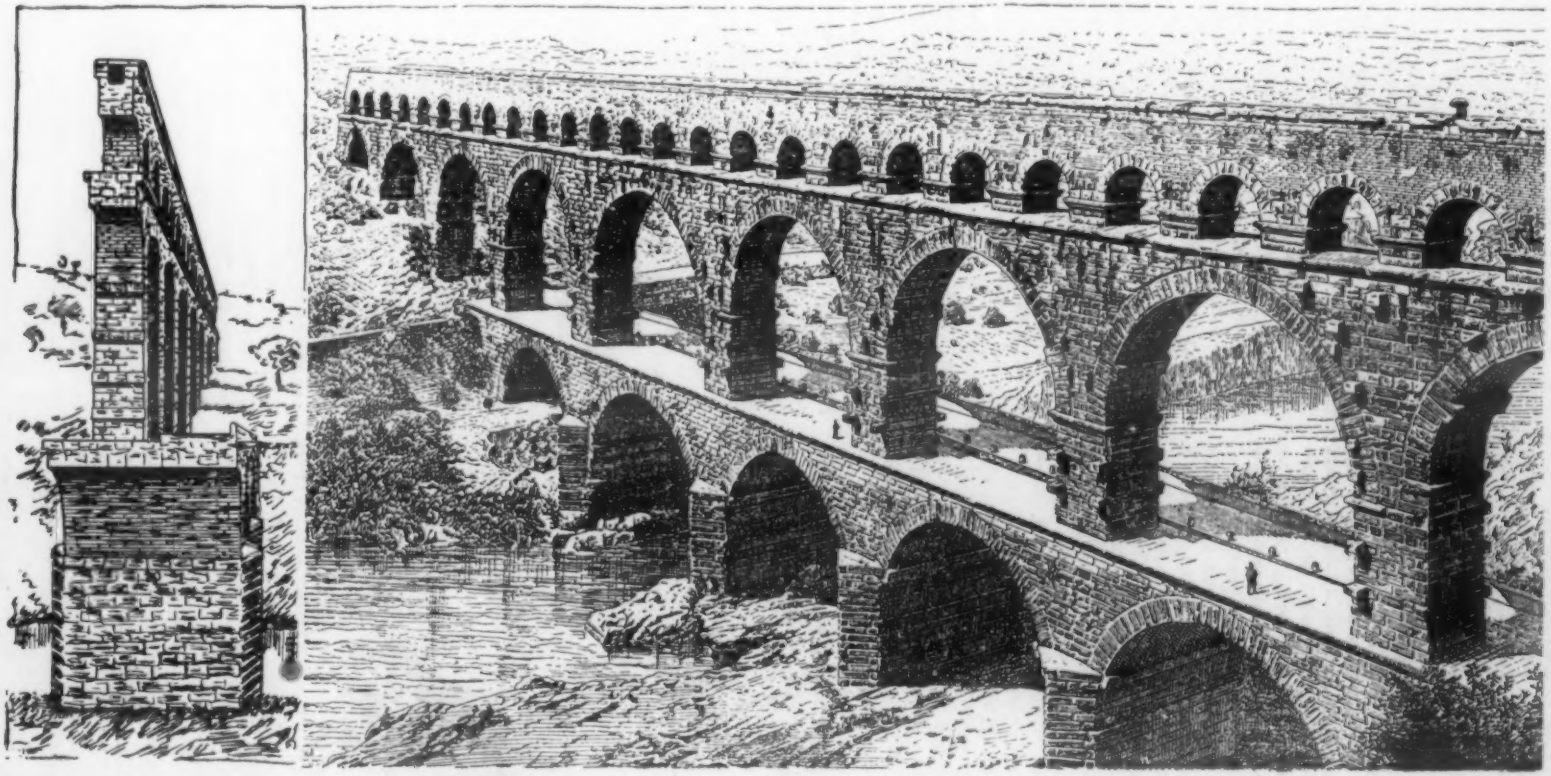
The atmospheric or sucking pump was invented in the year 1641. It was a mystery at that time why the pump would not raise the water higher than thirty-two or thirty-three feet. Two years later Torricelli discovered that the water was raised in the barrel of the pump by air pressure on the surface of the water.

The most complicated machinery ever constructed for raising water was erected and set in operation at Marli, near Paris, in the year 1682. The pumps were divided into three groups. The first set contained sixty-four sucking and forcing pumps, raising the water 160 feet directly from the Seine river, through an iron pipe, to a cistern 600 feet from the river. The second set, seventy-nine pumps, were placed at this cistern and raised the water 185 feet to a second cistern 1,344 feet from the first. The third set, eighty-two pumps, were placed at the second cistern and raised the water 188 feet in a distance of about 2,000 feet to a reservoir. Therefore, the water was raised 533 feet in a distance of nearly 4,000 feet.

The pumps were operated by water power from the Seine river, which was divided into fourteen distinct water courses, in each of which an undershot wheel was erected. The first set of pumps was operated by six wheels, while the remaining wheels transmitted power to vibrating levers and through these to the piston rods of the second and third set of pumps. Therefore, the upper set of pumps was stationed 345 feet above and 1,944 feet distant from the power that operated them.

The feasibility of raising the water directly from the river to the reservoir was demonstrated by an attempt made in 1738, but owing to the inability of the machines to stand the strain they were operated as before until the year 1775, when a trial was made to dispense with the first cistern, but the pipes burst and the old plan was resorted to until Napoleon ordered a steam engine of sixty-four horse-power to replace the water-wheels. Consequently these pumps were in use and operated by water power for a period of at least 100 years. The hammering, rattling and creaking noise of the working of this machinery has been described as something hideous. It would be well to note the advancement made in the method of transmitting power in the last two hundred years by comparing the operating of these pumps with the noiseless and invisible movement of transmitting power by electricity.

The first water works of Philadelphia, Pa.,



This section made from the accompanying view by Thomas McE. Vickers, C. E.

THE PONT DU GARD AQUEDUCT OVER THE RIVER GARDON, NEAR NISMES, FRANCE.

It is 180 feet high and 873 feet long. The channel is about five feet high and two feet wide. Supposed to have been built 19 B. C.

were put into operation January 27, 1801. An engine was placed at the corner of Schuylkill, Front and Chestnut streets. The water was pumped from the Schuylkill river into a brick aqueduct which was six feet in diameter and 3,144 feet long, leading to the Center Square engine house at the crossing of Broad and Market streets. Here another engine pumped the water into two wooden tanks set in the top of the building fifty feet above the bottom of the brick tunnel. The tanks were ten and fourteen feet in diameter and twelve feet deep. The engine could not fill them in less than twenty-five minutes. The pumps were double-acting force pumps. They were made of wood and lined with sheet copper to prevent leakage. The steam cylinder of the Central Square engine was cast in two pieces, united by copper. The joint was secured by a cast iron sleeve eighteen inches wide. The cylinder was thirty-six inches in diameter and six inches long. Nearly four months were spent in boring it. The steam boilers were made of five-inch white pine plank. They were boxes nine feet high, nine feet wide and fifteen feet long. They were securely bolted and braced. Inside of each was a wrought iron fire-box with vertical cast iron flues. The lever-beams, shafts, fly-wheels, etc., were also made of wood. The water was distributed through the city in pipes of bored logs six inches and four and one-half inches in diameter. Construction of the works commenced in the year 1799.

In contrast with these early contrivances it is interesting to note that there is perhaps no engine in the world which has a capacity equal to that of the pumping engine "Michigan," which was built from designs of Mr. E. D. Leavitt. It has a capacity of 60,000,000 gallons in twenty-four hours against an average head of fifty-one feet. It is located at the Calumet and Hecla Stamp Mills, Lake Linden, Michigan.

The first person who is known to have raised water by a water ram was Mr. Whitehurst, of Derby, England, in 1772. He conveyed water through a one and a half-inch pipe a distance of about 600 feet with a fall of sixteen feet to furnish water directly to the lower part of a building. When a faucet in the building was opened the water in the pipe was set in motion and as soon as the faucet was closed the momentum of the long column of water opened the check value and part of the water after passing through an air chamber rushed up a vertical pipe higher than the spring to a tank in the upper part of the building. This effect took place every time the faucet was opened and closed. The self-acting water ram was invented by a Frenchman in the year 1796. By using two or more rams and connecting their ascension tubes into one, water has been raised at Marli, in France, to a height of 187 feet.

The origin of the syphon is lost in antiquity. It was, however, used in Egypt as early at least as 1450 years before Christ. In the tomb of Amunoph II., who reigned in that period, there is a delineation which represents the syphon apparently in operation drawing liquid from one vessel to another. A syphon of extraordinary size was built for the Quindaro water supply of Kansas City. It leads from the intake crib to the pump wells, a distance of 745 feet. It is forty-two inches in diameter; its rise is ten feet above low water and its capacity is about 50,000,000 gallons per day.

A conduit discovered near Patara was formed of stone blocks about three feet square, through which a tube about thirteen inches in diameter was cut. On one end of each block there was a projection which fitted into a recess three inches deep in the face of the adjoining stone, forming a socket and spigot joint which was filled with cement. The blocks were secured together by iron clamps run with lead. The date of the construction of this conduit is lost.

Great and important advances in the science of engineering in the methods of distributing water have been made through the manufacture of pipes. The ancients, so far as we know, made only a limited use of pipe. Although the Romans carried their systems to a high degree of perfection, they preferred brick or stone conduits to lead pipe, which was the only metal conduit they had at their disposal, excepting a bronze pipe which was difficult to manufacture. These lead pipes were made in lengths of ten feet by bending sheet lead upon a cylindrical form and soldering the edges. Thus they were ill-adapted for the conveyance of water under pressure. Earthenware pipes were also used. Some were made to screw into each other. Most of the great houses or palaces were supplied with water which flowed constantly into basins of stone of marble. Water was rarely carried by pipes to the upper stories. A lead pipe of great antiquity was recently found under the street in Rome. The pipe was not less than two feet in diameter. It was re-enforced in ancient brick masonry.

A conduit with an inverted syphon of cast iron pipe was constructed in the year 1782 to supply Genoa with water. I have been unable to find any record of cast iron pipe having been used prior to this date. Pipes formed of stone artificially hollowed out

were laid down in considerable quantity in London and in Manchester in the early part of the present century. The result in each case was a disastrous failure.

In the early days of London's water supply the distributing mains were made of bored trunks of elm trees, and in most cases they were six or seven inches in diameter. Owing to their small capacity it was necessary in many cases to lay additional lines. In the year 1810 there were nine lines laid side by side in one street. At the end of the last century they commenced to use cast iron pipe. About twenty miles of wooden pipe were removed annually until the year 1820, when all the mains of the New River Water Company, about 400 miles, were replaced by others of iron, of diameters from one to three feet. The cast iron pipes were screwed together at the joints. This prevented their free expansion and contraction, and often caused them to be broken by the varied temperature of the water, rendering them very defective in the winter season. Cylindrical socket joints were then introduced. They were accurately turned in a lathe. No stuffing was used other than a little whiting and tallow. The pipes were driven up in the joints. They were made in lengths of nine feet. The service connections were made by flanged joints cast with the pipe.

Until about the year 1850, or a little later, London and many of the principal cities and towns in England were supplied by the intermittent method, the water being turned on and off in the mains once or twice a day, or once in two or three days, as the case may have been, to fill tanks in the houses. Liverpool had an intermittent supply until the year 1873.

The first improvement on the ancient method of making lead pipe was in the year 1539 in England. It was then cast in an upright position in short lengths. The lengths were united in a mould by pouring hot metal over the ends until they were run together. Later on lead pipes were made by casting them in moulds laid in a horizontal position. After a short piece was cast it was almost entirely drawn from the mould. The mould was then refilled with hot metal which fused with the first piece and increased its length. It was then partly withdrawn and more metal poured, increasing the length as before, and so on until the pipe was made the required length. The present method of making lead pipe was patented in England in the year 1820.

The process of making wrought iron tubes was invented and patented in England in the year 1824. These have been extensively used as service pipes, but in many cases, owing to the nature of the water, they have soon corroded and leaked. In other cases oxidation and incrustations have seriously diminished the capacity of the pipes. Many experiments of coating the pipe have been made from time to time with a view of preventing its deterioration. The most durable and effective coating appears to be a lead lining. The lead lined iron pipe was first made about ten years ago. The method of making it is as follows: A reamer is run through the iron pipe making it smooth and true. It is then heated. The outer surface of the lead pipe is covered with a cement and then drawn into the iron pipe, followed by an expander which runs through the pipe its entire length. Wrought iron pipes are lined with tin in the same manner.

The water meter was first patented in England in the year 1825, and in America in the year 1848. Where it is used it restrains a great wastage of water. Many cities have erroneously demanded an unnecessarily large supply of water and have unduly increased their works by building reservoirs, conduits, pumping stations, etc., while, if all their services were metered, they would find that the supply first available would serve a population two and three times as large. The meter is a great economizer. It saves many thousands of dollars in the cost of pumping. It is an honest arbitrator between the supplier and consumer, and it is a better inspector than the most competent man.

In conclusion, it is my hope that this and future generations may enjoy many improvements in the art of collecting, storing and distributing that beverage which is provided by our Creator to cherish and invigorate His creatures and to beautify the world.

WATER METERS AND RATES.

By John B. Heim, Superintendent City Water-Works, Madison, Wis.

Ten years ago the prejudice against the the measuring of water was so strong that it often cost the official head, if insisted upon. Because of the rapid strides and satisfactory results of the meter system since then, wherever adopted, it ought not to be as difficult to procure its introduction now. A careful and shrewd business manager cuts off all unneecessary waste, and at the end of the year finds his gains. Why should he not do the same with the water? Because it appears that the water drawn from the lakes or rivers seems plentiful, and therefore ought to be free as air, is not good

reasoning. People forget that it requires machinery and fuel to pump and furnish water, and that every gallon costs money. There is no need for stinting the plentiful use of water, and the rates can be fixed accordingly. The mission of the meter is not to deprive us of plenty of water, but to prevent its waste. The tendency of all of us is to get as much as we possibly can for little or nothing; we always want the lion's share, if only some one else pays for it. Indirectly, we probably pay double for it.

To my utter astonishment, I noticed in the water works journals of last July, that a citizens' committee of Savannah, Ga., petitioned its water commissioners to abolish the meter system, claiming that the meter system tends to restrict the legitimate use of water, thereby endangering the health of the city, and aside from that, that their meters were so defective as to give rise to serious irregularities and injustice. From statements given, the city owned and had placed 200 meters on one street, controlled and repaired them. After giving this committee a hearing and investigating the charges, the commissioners decided to abandon the meter system and to return to the old plan of assessing the rates. Can it be possible that after investigating these charges, such should be the outcome? It is stated that the supply is drawn from deep wells and the water is of excellent quality. Nevertheless, they abolish the meter system, knowing that such a supply is limited.

It is a mistaken idea that a meter system restricts a legitimate or a plentiful use of water. There is not a water works in existence that has adopted the meter system that for one moment desires to restrict the use of water for necessary purposes and plenty of it, desirable from a sanitary standpoint. Their only aim is to restrict the careless waste and leaks. We find in our city that the water meter is a fairly accurate instrument, and we are anxious for the day when every tap is metered. We teach our takers how to read the meter; we purchase only the straight-reading meter, so that any one in the family can read it, and we ask them to read it when we find an unusual waste. We call their attention to it and assist them in reading it wherever we can, and today we have but little complaint of the water bills. If there are complaints, they are from patrons who pay no attention to our notice or neglect to repair the leaks. The proper course to pursue to prevent stinting in the use of water is to adopt a minimum rate. Then establish a rate that will give plenty of water for all necessary purposes. The selling of water by meter measurement is the only fair and just principle. The careful person, as well as the extravagant, gets value received. Under the schedule rate, the careful person pays for the extravagance of the other. Under the meter system, if a taker has a large lawn, takes pride in it, sprinkles all day, he pays for it the same as if he desires the best in the market for which he is willing to pay. Under the schedule rate the other takers are obliged to assist him in keeping his lawn fresh and green. Our meter system is now in its tenth year and very popular. Should we decide to go back to the schedule rate, there would be such an uprising in opposition that woe be to the man who would father it.

Our schedule rates are: For a six-room house, $5; one water closet, $2.50; one bath tub, $3—$10.50 per annum. At this rate we collect for the first six months in advance, for a new building or an old service, where a meter has been placed; after that per record of the meter the preceding six months. We close our records the first of June and December, to be ready for collection by the first of January and July. Here is where we discover the great objection to the schedule rate. We considered our schedule rate, before adopting the meter system, a very low one, but the meter rate brings the water rent considerably less, where there is no waste, and naturally the patrons want the lesser rate. Another objection to the meter system is the fear of financial results. We will give you a few illustrations of our experience and you can judge for yourself.

1. In 1888, when we adopted the "General Meter System" and commenced placing the meters, at the expense of the city, we discovered some very great leaks. The leaks were not repaired for several days, so that we could see what they amounted to: I will only mention three. In one instance the city received under the schedule rate $12 per annum, the waste under meter amounted to $600 per annum; the annual average payment now, under meter, with more fixtures, is $42.48. Another instance: The annual schedule rate was $32, the waste was $912, the annual average meter rate now is $368.33. The third instance: The city received under schedule rate, $60 per annum; the waste amounted to $949. The city now receives on an average of $45.68 per year.

2. To further illustrate, I will give the saving of the water and fuel. We will give the pumpage of the two coldest and the two hottest months of the year previous to the adoption of the meter system, and the ninth year of the meter system, with 263 takers still without meters.

In the month of December, 1886, we had 980 takers; we pumped 25,517,200 gallons of water. December, 1896, with 2,334 takers, we pumped 24,092,500 gallons, a difference of 1,424,700 gallons less than in 1886. In January, 1887, 980 takers, we pumped 23,450,100 gallons. January, 1897, 2,334 takers, we pumped 25,458,000 gallons; 2,008,000 gallons more than in 1897. July, 1887, 980 takers, we pumped 24,239,500 gallons. July, 1897, 2,334 takers, 27,845,500 gallons; 3,606,000 more than in 1887. August, 1887, 980 takers, we pumped 25,917,500 gallons of water. August, 1897, 2,334 takers, we pumped 22,487,500 gallons; 3,430,000 gallons less than in August, 1887; only 760,000 gallons more in 1896-7, with 1,354 more consumers and an estimated free water of 131,000,000 gallons of water, against 35,000,000 gallons in 1886-7. The average pumpage per day in 1887 was 715,885 gallons; in 1897, only 794,446 gallons. In 1887, with a minimum of $6 per annum, 980 takers and no meters, we collected $13,479.69. Last year, with a minimum of $4.50 per annum, 2,071 meters and 2,334 takers, we collected $21,471.64.

Our consumption of coal in 1887 was 1,124,200 pounds, or 1,148 pounds for each taker; last year it was 1,470,600 pounds, or 630 pounds for each taker. We commenced placing our meters on the 21st of May, 1888; on the 1st of October we had 210 placed. We therefore cannot consider this year in the saving of fuel, but as we checked some very flagrant wastes I have brought it within my calculations on the actual saving.

During these ten years, averaging 207 meters added each year, the actual saving on fuel was $16,893.19, a saving of over 44 per cent. on the investment of meters. Last year the saving on fuel was $2,066.82, our coal being $3.99 per ton, against an average of $5.25 per ton heretofore. In 1887 we pumped for each taker 266,642 gallons. In 1897 only 124,667 gallons, less than half, and including over 4 per cent. more free water.

3. Another illustration of the reform that the meter system has brought about is in collecting water rents. One patron under the schedule rate paid the city $22.50 per annum; a meter was placed, and the first monthly reading showed a leak. The patron was notified; he insisted it was the meter and wanted it removed, which, of course, was not done. When he came to pay the water rent, he found a bill of $15.94 for six months, and he again insisted it was the meter. We offered to test it, let him supervise it in every shape or manner and if the meter did not register exactly he would not have to pay a cent. He accepted our offer, tested and found our statement correct, but being still unsatisfied, asked for another meter. We gave him another, but this meter showed the same leakage. Then he followed our advice, found the leak and repaired it, and his average water bill since (now nine years) has not been over $15.34 per annum.

In another instance, where the general average was between $3 and $4 per annum, a leak occurred; no attention was paid to us; bill amounted to $27.38 and had to be paid, and is now back to its original average. Again, three tenements on one service; three separate meters independent of each other, same fixtures to each: One paid $4.50, the other $9.03, and the third $24.31 per annum, the latter a very careless tenant, indifferent because the landlord paid the water rent. The three are now down to $4.50 per annum each. Another tenement family during three years paid on an average of $13.18 per annum. This family moved out and a new family moved in. The water rent advanced to $16.01 in six months; allowing the water closet to run continually. The next bill was only $5.20.

Another house rated under schedule $20.50 per annum; the meter reduced it to $14.37 on an average. A new servant took a notion to let the water run, and increased the bill to $22.81. It is now back to the original.

One other objection to the meter system is the free water craze. The cry is, water should be free as air. Such it is when vouchsafed to us by a kind Providence in the form of rain or snow, but it also requires the energy of the elements through the laws of nature. If we have a well at our doorside, it costs money to build and repair the same. When we desire to enjoy a boat ride and we are in the midst of a river or lake rowing the boat, and we want a drink, it costs us twenty cents or more an hour, unless we carry the nut brown beverage with us, which is still more expensive. When we lay water mains, with wells or the water supply from mains near at hand, it costs 50 cents a day for a water boy. Where is the water free as air? The operation and mode of supply must be paid for by those who get the benefit, and the rates must be fixed accordingly. Let us compare our city, with a population of 17,884, supplying 73 per cent. of our inhabitants, with another city not a great distance from us, with a population (census 1895) of 28,769, supply only 50 per cent. of its inhabitants, where they have no meter system and the water seemingly is as free as air. They have 2,908 takers, 574 more than we have, and four miles more of mains. Their annual pumpage was 1,627,852,100 gallons during the year; we

pumped 290,972,750 gallons, only a slight difference of 1,336,879,350 gallons more than we pumped; their daily average was 4,459,870 gallons, against our 794,446 gallons; their per capita is 155 to our 45 gallons per day. They consumed 3,857 cords of pine slabs, at a cost of $5,586.54. We consumed 735 tons and 600 pounds of anthracite pea coal, at a cost of $2,933.85, a difference of $2,652.69, not considering the kind of fuel. They expended $32,000 in new pumps, and they are inadequate; we invested $38,000 in meters, of which we have already saved over 44 per cent. in their cost on the fuel, and will increase that saving from year to year. When fire pressure is demanded of us, the water is not oozing from a thousand and one openings, reducing our pressure, crippling our usefulness and weakening us when demand is made upon us in case of a large conflagration. The free-water people forget that they are standing in their own light and are paying for this free water indirectly and might be so unfortunate as to suffer a great loss by fire through the want of fire pressure.

Another very difficult problem to solve is that of meter rates. We have made the rates a study for years. With the best intentions, we are bound to do injustice to some; therefore our endeavors should be in the direction of the least possible injustice. The three most difficult, and at times very expensive, parts to be considered are the source of supply, filtration, and the fuel. Our water supply is from artesian wells; therefore, filtration is not in our consideration, but the fuel bill plays an important part. Our pumping station being located in the residence portion, in the midst of a park, surrounded by costly dwellings, we are compelled to use hard coal. The average cost of our coal for the past ten years has been $5.25 per ton. Our annual operating expenses average between eleven and twelve thousand dollars. Therefore, with the above considerations in view, we fixed our meter rates. First, we established a minimum rate. Second, we decided that every taker, whether large or small, should pay for the first 5,000 cubic feet the same rate; after that a sliding scale for the benefit of the large takers and in proportion to the use, viz.: If a party consumes 90,000 c. f. in six months he pays for the first 5,000 c. f. $10; for 10,000 c. f. $15; for 20,000 c. f., $25; for 30,000 c. f., $30; for 40,000 c. f., $33; for 50,000 c. f., $36; for 60,000 c. f., $39; for 70,000 c. f., $41; for 80,000 c. f., $43; for 90,000 c. f., $45; all over 90,000 c. f., at 5 cents a 100 cubic feet. Having only one large factory that consumes a large amount of water, and our city being a resident population, we cannot sell water at less than 5 cents a 100 cubic feet at the present time. We sell by the cubic foot because it is indicated so on the meter; the takers can read the registration and govern themselves accordingly. Our rates are:

First 5,000 cubic feet or less, per six months, per hundred cubic feet, 20 cents.

Over 5,000 cubic feet and up to 20,000 cubic feet, per six months, add $10 for first 5,000 cubic feet and 10 cents for each additional 100 cubic feet.

Over 20,000 cubic feet and up to 30,000 cubic feet, per six months, add $25 for first 20,000 cubic feet and 5 cents for each additional 100 hundred cubic feet.

Over 30,000 cubic feet and up to 60,000 cubic feet, per six months, add $30 for first 30,000 cubic feet and 3 cents for each additional 100 hundred cubic feet.

Over 60,000 cubic feet and up to 90,000 cubic feet, per six months, add $39 for first 60,000 cubic feet and 2 cents for each additional 100 cubic feet.

Over 90,000 cubic feet, per six months, per 100 cubic feet, 5 cents.

Minimum, per six months, $2.25.

The method of figuring under these rates is very simple, as examples will show, to-wit: A patron having consumed during six months 7,316 cubic feet, deduct the first 5,000 c. f., which cost $10.00, multiply 2,316 c. f. by 10 cents, $2.32, add the $10.00, and the bill is $12.32. If he consumed 16,789 c. f., deduct 5,000 c. f., multiply 11,789 by 10 cents, $11.79, add $10.00, equals $21.79. If 26,382 c. f., deduct 20,000, which leaves 6,382 c. f. at 5 cents a 100 c. f., $3.19, add $25.00, and the bill is $28.19. If 50,110 c. f., deduct 30,000 c. f., multiply by 3 cents, $6.03, add $30.00, equals $36.03. If 78,999 c. f., deduct 60,000 c. f., leaves 18,999 c. f. at 2 cents a 100 c. f., $3.80, add $39.00, equals $42.80. You will note that by this method every cubic foot is considered and the assistance given to the larger taker according to his business and demands.

We adopted these rates two years ago, and they have been very satisfactory and met with general approval. There is the least disinclination, and no encouragement to waste water to get a lesser rate. Our experience has taught us the idea that there ought not to be a flat rate. Each taker, whether large or small, to pay the same rate would be a gross discrimination against the larger taker, and result in a deficit in the exchequer, and, necessarily, higher rates; whereas, with a sliding scale all are treated as nearly as possible impartially. If there was only one price in

the fuel, per ton of coal or cord of wood; that is to say, if we had to pay for 600-800-1,000 or more tons of coal or cords of wood to pump the water the same price it costs us for our own private use, what would be the result? Who would pay the difference? Would not the taker? The small as well as the large taker derives the benefit of the lesser cost in fuel. There must be a minimum rate, as it costs as much to take care of a small as it does of a large consumer. If we purchase a half ton of coal the cartage is the same and the labor nearly so as if we had purchased two tons. It is so in all commercial lines; why should it be different in the sale of water?

I trust that I have added in a small way another solution of the great problem that baffles so many water works officials—that of securing an abundance of water at a lesser cost, lesser in the avoidance of the purchase of pumping machinery, lesser in the cost of filtering the supply and better able to secure a pure and wholesome water from artesian wells in smaller cities. The meter is the detective, the guardian, the adjuster, the salvation of the water supply and of the finances. A thorough trial of the meter by the water works officials and by the citizens will soon convince them that the only fair and just way to sell water is by meter measurement.

CLEANING RESERVOIRS.

By Dow R. Gwinn, Superintendent Water-Works, Quincy, Ill.

Cleaning a reservoir is not the kind of a job that one is anxious to do, but when the necessity exists the sooner it is done the better. If the reservoir has a hard, smooth bottom, with sufficient fall to the waste pipe to carry off the mud and water rapidly, the task is not a difficult one. The writer has had experience in cleaning two reservoirs; one is used for settling purposes in connection with a filter plant, and is 70x70 feet, 7 feet 6 inches to 9 feet six inches deep, with a fall of 2 feet from the point most distant to the waste pipe. After using for several months it is necessary to wash out the sediment, which at the point of inlet is usually about 4 feet 6 inches deep, the balance being covered to a depth of from 12 inches to 7 inches deep. After the reservoir has been drained, pumping is resumed, the filters being supplied direct from the pump, and the surplus water used for washing the mud. With nine men the sediment is removed in about three hours. The other reservoir is used for storing filtered water, and is 246x343 feet at the bottom, 25 feet deep. The bottom is of clay puddle, nearly level, except within a radius of 30 feet of the waste pipe, where the fall is about 18 inches in that distance. The inlet has been changed, but at the time of the clearing it was in the southwest corner while the opening into the waste pipe is in the northwest corner, or directly opposite the inlet. There is only one hydrant accessible, and to get sufficient pressure for effective washing streams it would have been necessary to run the pressure to about 175 pounds, possibly higher in the lower districts.

It was finally decided to wash the mud with water pumped into the reservoir at the inlet and have plenty of laborers to stir the mud in the stream of water as it flowed to the waste pipe. While the reservoir was empty the city was supplied by direct pressure; the inlet valve is 20 inches in diameter, requires 196 turns to open, and while cleaning was being done it was open 12 turns. To prevent any damage from suddenly increased pressure or water hammer, the hydrant near the reservoir was opened, and to it was attached 150 feet of 2½ inch hose, laid to the top of the reservoir embankment. To move and stir the mud 20 laborers were employed, who were provided with wooden scrapers such as are used to scrape snow. We tried several sizes, and found that the men did the best work with the board or blade 8 inches wide and 1 foot 6 inches long, the handle being 1½ inches square. In cleaning a reservoir in this manner it is of the utmost importance to wash that portion of the reservoir first which is not on the natural route for the water from the inlet to the waste valve. We began by making a channel in the mud about 8 feet wide, commencing at the inlet and running along the foot of the south bank, continuing along the east bank, thence along the north bank to the waste pipe in the northwest corner. The mud from this channel or trench made a kind of embankment, which prevented the water from making short cuts to the waste pipe. Water was then admitted, and the men scraped the mud with the stream until the space covered by the water was free from mud. The clay puddle was distinct from the mud, and there was no difficulty in deciding where the mud left off and the

puddle began. Once away from the bank it was necessary to confine the water where reeded for washing; to do this we used 2 inch and 3 inch planks 1 foot wide and 20 feet long, placed on edge and end to end; near the end of each plank was nailed a triangular board, which held the plank on edge.

In preparing to clean a section two lines of these planks were used, and they were placed parallel, about 8 feet apart; the upper end or inlet started at the open trench along the east bank, and the lower end or outlet was near the waste pipe. The water was then admitted into this section, and the mud scraped along with it as it flowed to the waste pipe. When this space was cleaned the boards were moved south to the next section, and so on until the whole surface had been cleaned. The planks when in position were bedded into the mud and puddle with a maul, a few strokes being necessary on each plank. Where the pressure on a particular plank was unusually heavy a stake or two was driven on the lower side. Iron clamps made of ½ inch iron 6 inches wide, shaped like a letter "U," say 10 inches long, to go over the joints where the planks come together, would be of service in keeping the line intact; stakes would not be necessary if clamps were used.

Considerable time could be saved by having sufficient boards to make three lines, so that one set of boards could be moved ahead, and as soon as one section was washed another would be ready for the water to be admitted. As stated before, the average depth of the mud in our reservoir was 9 inches, and what has been written applies more particularly to that depth, but if the mud was much deeper it would not be necessary to have a row of planks on the side in the direction in which the work was moving, as the material itself would be a sufficient dam. We learned that it was desirable to keep the mud from drying, as it washed much easier when soft, and at night the waste pipe was closed and sufficient water admitted to flood the bottom. There were 2,000 cubic yards of mud removed, and the time required was eight days. The expense of removing the mud, including the cost of planks, rubber boots, etc., but exclusive of water, was 15 cents per cubic yard. The amount paid for labor was about 10 cents per cubic yard.

CAST-IRON PIPE INSPECTION.

By W. T. Yardley, of Chicago.

The importance of a careful inspection of cast iron pipe for water works has grown in the past decade so materially that few engineers and superintendents are willing to accept pipe from the maker's standpoint of excellence. This is not to be wondered at, when we know the inspector in the employ of the company making the pipe has but one interest to subserve—that of his employer. If the maker of pipe would require from his inspector the same care that an outside inspector takes in the interest of the purchaser there would be very little use for an outside inspector. There are many points for an inspector to watch carefully, and it is not surprising that an employe of the maker should overlook some of the most important ones. For instance, pipe made in cold weather should not be taken from the casting pit while showing the color of heat; if so, internal strains will exist if the shell is of uneven thickness, and to the detriment of the life of the pipe.

There is no metal so unreliable as cast iron when unfairly treated, but when fairly treated it is one of the most reliable. Many of the engineers and superintendents of water works throughout the New England states refuse to take any pipe from a day's cast that shows from ten to twenty per cent. rejections, for the reason that no one can tell how near the danger line the accepted pipe may be; while the accepted have passed all careful inspection it is not a sure thing that the accepted pipe will stand in case of a water ram that is liable to occur at a fire, when a valve may be closed suddenly. The force of the blow under these conditions will be of greater force than the hammer test when the pipe is filled with water, free of air, and subjected to a pressure of 250 pounds per square inch. Inspection of pipe is of no value to the buyers unless well done; it is simply money thrown away. Fifteen years ago there were very few inspectors sent to pipe works to look after the interest of the purchaser; during that time many mechanical devices have been introduced which have cheapened the cost of production and enabled the makers to increase their output; but these devices do not insure regularity in thickness of shell or perfect hubs, to say nothing of cold shuts and other imperfections caused by the iron being poured too cold. All of these points should be carefully watched by the inspector, and

if he does his duty he will look after this, and it is for this that the purchaser pays for careful inspection. The cost of inspecspection is so reasonable that no water company should hesitate regarding the employment of competent inspection. The railroad companies, as a general proposition, have all the rails and splice bars purchased inspected. After years of such experience these large interests have almost unanimously united on the value and importance of good inspection. This is so with water works companies, but more important to the latter for the reason that pipe are under ground and, therefore, cannot be looked after so well as the rails and appliances above ground. As pipe lines are extended the pressure is often increased, and therefore the more important that pipe should be of uniform thickness of shell and free from imperfections due to careless cooling, etc. In many towns direct pressure from the pumps is secured, often running the pressure up to one or two hundred pounds pressure per square inch.

At the time of the fire in Jackson Park, during the Columbian exposition, there were often sudden calls for a large amount of water, and the pressure was increased from seventy-five to one hundred and fifty pounds per square inch. There was laid in the exposition grounds at Jackson Park some thirty-five miles of water mains. After the pipe was laid test pressure was applied of 100 pounds per square inch. All the exposition buildings were amply provided with this protection, and to make it effective a pressure of 75 pounds per square inch was carried constantly on the mains. There were 96 fire alarms during the time of the exposition, from May 1 to October 31, 1893, and no fire engine did any service on buildings where the protection existed. As soon as the alarm was struck the water pressure was run up to 100 or 150 pounds; this was a positive order, which was regularly and imperatively carried out. The most severe trial of any pipe in the system was given the 24-inch main supplying the electric fountain. This water was pumped directly into the mains, and the service required that any or all jets were to be thrown on or off instantaneously; the pressure carried was between 80 and 90 pounds, running up to 150 pounds at the pumps on the sudden shut off. The severity of the test can be appreciated by one who comprehends the impact imparted by such a blow through such a non-elastic agent as water. I make this presentation of facts to emphasize more fully the value of good inspection.

EXPERIENCE IN FILTRATION AND AERATION.

By S. A. Charles, Superintendent of Water-Works, Lexington, Ky.

The city of Lexington, Ky., is supplied with water by an impounding reservoir of about 120 acres in area, dependent upon the rainfall and the drainage area of about 3,000 acres for its supply. During the hot months, from June to October, inclusive, our reservoir gradually becomes filled with algae and vegetable matter, at times in hot weather emitting an unpleasant odor. We also occasionally have an influx of mud after a heavy rain, but this last we regard as a trivial matter in comparison with our troubles with algae, and the problem that has confronted us has been not merely the removal of mud, algae and foreign substances, but especially the removal of odors.

Our exeprience leads us to believe that deodorizing cannot be done by filtration alone, and that aeration must be relied on for this purpose.

We believe we have succeeded in this object in a simple, inexpensive way, and after three years' experience we cannot think of any change to be made in the theory or plans on which we have worked except possibly to enlarge and carry the ideas still further.

We use mechanical filters of the type known as the "gravity filter." We adopted this style because it is open to inspection the same as a filter bed, or even more so, and because the rate of filtration like that of a filter bed is dependent on the head of water and the filtering area. It also has the merit of being open, and affording an opportunity for the escape of all gases and odors, and entirely prevents carrying air into the water mains and the formation of air pockets.

The pressure filters (so called) seem to me to be based on faulty theories.

First. The resistance must increase as the film on the surface of the sand thickens, and an ever growing and uncertain pressure must be maintained to force the water through. This means not only decreased efficiency of filtration, but also increased coal bills.

Second. Pressure tanks are usually of iron, and however dilute the coagulant used may be, yet if alum or sulphate of albumina is used, the result must be to corrode the iron of which the tanks are made.

Third. There is no opportunity for aeration or for any gases or air to escape. Whatever air or gas goes into a pressure filter must appear in the mains in the shape of air pockets, or escape at the faucets where delivered to the customers, sometimes much to the anonyance of the customers' olfactories.

For the above named reasons we have adopted the gravity filters at Lexington, and contend that there is no result which it is possible to attain by the use of filter beds that we cannot attain by their use. There is certainly some number (more or less) of gravity filters which will produce the same result as so many acres (more or less) of filter beds, and if the original number of filters is not sufficient it is an easy matter to add to the number.

The use of a coagulant very much increases the safe rate at which water may be filtered. The film which forms on the surface of the filtering material and which is so effective in thorough filtration forms rapidly when a coagulant is used, and slowly when it is not. There is therefore little or no lost time with a mechanical filter as compared with a filter bed.

Still there are limits which cannot be safely exceeded with any filter whatever, and I am inclined to think that in many cases the same as with filter beds, too much has been expected from too little area, and that manufacturers of mechanical filters and their customers also, from motives of economy have endeavored to get along with too small a filtering surface.

There is no reason that I can see why sand in a filter tank will not do all it will do in a filter bed, and such additional amount as is due to the use of coagulants, and the shorter time lost in cleaning.

But there are some advantages derived from the use of mechanical filters which should be taken into account. Among these are economy of space and also original cost and the substitution of machinery for manual labor. Why should a week be spent in cleaning where a few hours with suitable machinery would suffice. Again the mechanical filters offer facilities for sterilization by live steam and for thorough cleansing of the sand used by washings which do not seem praticable with a filter bed.

The special features of our own plant and which we think the principal cause of such success as we have had in filtration and especially in the removal of odors are the thorough aeration given to the water and the mode in which we add the coagulant.

We aerate by letting the water fall in a spray of about 1,600 fine jets through a perforated pipe, a distance of about seven feet to the filter below. After passing through the filters it passes through a charcoal vat with a perforated button and again falls in a spray to the clear water basin.

This simple method of aerating has been quite effective and has entirely removed all odors. We have an air compressor in reserve which was originally designed to aerate by blowing sprays of air through the sprays of water, but so far we have had no occasion to use it, the aeration by spraying through the air being sufficient and saving the cost of running the compressor.

The depth of sand in our filters is thirty inches and the annual loss is about six inches. We use white sand (Horn island) which we get from New Orleans at a cost of a little over a dollar a barrel,—making our annual expense for sand about one hundred dollars. The upper six inches of sand seems to do all the work and it is seldom it is strained below that depth. We wash from four to five times in twenty-four hours in hot water, and use water quite freely in so doing, as none of it is lost, but all gets back to the reservoir after a settling and straining process.

We have experimented with sand and crushed quartz of various degrees of fineness but have found little or no difference in the results; the film or coating which rapidly forms on the surface of the sand seeming to do the work about the same in either case.

We have also experimented with settling basins with a view of taking part of the work off the filters, but found it impracticable, for the reason that the algae and vegetable matter with which we have to contend, is so light that it will not settle, but floats or remains in suspension, leaving us no alternative but to let the filters do all the work.

As regards the use of a coagulant I think much of its effectiveness depends upon how it is used and I cannot, I think, do better than quote from my former report:

"We have a little simple device somewhat on the principle of an injector worked by the rock shaft of our low service pump and worked automatically, which at every stroke of the piston injects a fixed and invariable amount of the solution. It is only necessary to vary the strength of this solution from day to day, or even from hour to hour if necessary, and it needs no further attention. The results are perfectly uniform; it

requires much less coagulant; and is positive and certain, irrespective of variations in pressure or speed."

The sulphate of alumina which we use as a coagulant varies in amount from a minimum of one-third of a grain per gallon to a maximum of one grain per gallon, varying with the condition of the water and the season, and will not average more than eight-tenths of a grain per gallon for the entire year. This small amount (small when the character of our water is considered) we attribute to our mode of injecting the coagulant by which we can vary from one grain per gallon to the thousandth of a grain with the utmost accuracy and regularity.

I estimate the cost of filtration and aeration at $6 per million gallons exclusive of interest on the cost of the plant, which was $27,000, but this is for an output of only a million and a half gallons per day. Better results should be obtained where the filtering is done on a large scale, and where cheaper coal can be obtained. I have figured the coal at $2 per ton.

The small output of one and one-half million gallons per day in a city the size of Lexington is accounted for by the fact that 95 per cent. of our taps are metered, and there is therefore no waste. In this connection I may remark that meters and filters properly go together, and should not be separated.

With regard to typhoid fever statistics, to which so much importance seems to be attached lately, we have no reliable data in Lexington, but this much at least we do know—that whatever cases there have been, were attributable to the use of wells and other sources of supply. In thirteen years there has not been one solitary case of typhoid fever, or any other disease which could be traced to the use of reservoir water. Such a charge has never been made against it.

There are some other matters which we think increase the efficiency of our filtration, to which I will briefly call attention:

First—All our filtered water is stored in a clear-water basin and is carefully excluded from the light and from any possible contamination from germs being blown into it. We find in our warm climate that any exposure to air and light results very quickly in what almost seems to be spontaneous generation.

Second—We provide at the lowest points in our mains, openings which we call "washouts" and through which we flush and completely empty the pipes at intervals during the hot weather. By opening and closing the proper valves, and putting on pressure at the pump house we can scour out almost any line at pleasure, refilling, of course, with fresh water. These "washouts" are much more effective than hydrants for flushing purposes, the discharge being directly from the main instead of from a point three or four feet above it.

The results thus far have been quite satisfactory to ourselves and customers. We have had almost no complaint whatever of the quality of the water since the installation of our filter plant, while before that time complaints were frequent.

FREE WATER FOR PRIVATE BATHS.

By L. N. Case, Superintendent of Water-Works, Detroit, Mich.

I am inclined to look at the word "free" rather suspiciously. I am inclined to reason thus: If anything is to be supplied free to "A," at the expense of "B," for, of course, everything that costs money has got to be paid for, I must know, before approving the idea, if the benefit accruing to "B" is commensurate with the burden of the extra expense imposed upon him. As to this proposition to furnish free water for private baths I find that the expenditures for establishing and maintaining a water works are, to a great extent, derived from the people from assessments made on the basis of certain established rates; that almost invariably bath tubs are charged for at an average price of $2 each per annum, and that the income from such source is considered necessary. Therefore, if the charge on bath tubs is abated, the amount formerly received therefrom must be derived from some other source, either by an increased charge on other fixtures or upon the family rate.

In Detroit there are 12,500 bath tubs which are in premises owned by people who are able, if not willing, to pay the small charge therefor, but which must be abated should "free baths" prevail.

The question as to how many of those now unprovided would be induced, by the abatement of the charge for water, to go to the expense of a bath tub, must of course be problematical. I cannot but think, however, that the percentage will be very small, and certainly not more proportionately than the inducement. It must be remembered that the pur-

chase and proper connections for a tub will amount to $15 or more, and it does not seem reasonable to suppose that many would be influenced to go to this expense by the fact that they would not be obliged to pay $2 per annum for the water used therein.

Now, supposing an appropriation is made to furnish tubs for all premises, utterly ridiculous and impossible as it may seem, there would still be lacking another feature to its success, and that is the obligation to bathe.

The class most desirable to reach from a sanitary standpoint is not particularly fond of water as a lavation. The old saying that you can lead a horse to water but cannot make him drink, is very applicable in this connection.

A friend of mine owns a cottage, next door to one occupied by himself, which is furnished with a bath tub. He says that, of his own knowledge, that no member of the last four families used this tub during their entire occupancy.

This is but an illustration of conditions that I believe generally prevalent among the laboring classes, and is but the result of an habitual neglect from childhood of personal cleanliness, growing out, probably, of their environments and the lack of opportunity or inducement to care for the same.

It would seem necessary, then, in order to make this proposition a success, to not only abate the charge for the water, but also to provide tubs, and in addition to enact an ordinance requiring each individual to bathe at regular stated intervals.

I most emphatically do not wish to be understood as opposing anything that is for the real benefit of the masses, their education or improvement. On the contrary, I am of the opinion that there is far too much neglect among the intelligent and wealthier classes of their less fortunate fellow-men.

There is, in my opinion, a grave responsibility resting upon those endowed with brains and money to take careful thought of the conditions of those less favored, and to direct and control the influences that will tend to improve those conditions.

If we are anxious to do them good, to elevate them mentally or physically, let us devote our energies and means on the lines of practical common sense.

I am aware that this proposition will be sustained by the argument that the expense can be imposed upon the property, on the ground that the possessors thereof will derive a benefit from the improved sanitary conditions. This might be partially true if its establishment should produce the result contemplated; that is, the establishment of bath tubs in the apartments of the working people.

I am satisfied, however, that this would not be the result, because, in the first place, of the expense of the tub and its attachment, and, in the second place, on account of the absence, generally, of the desire to avail themselves of the privilege so provided.

This, to me, is an entirely different question to the establishment of public baths. In the latter case, the tub, the water and all the appurtenances are provided. One thing only is lacking, and that is the inclination, and this would be fostered and often created by the very novelty of the enterprise.

No! gentlemen, in place of trying to "eclipse the free public baths of Europe" by instituting free water for private baths in America, let us rather advocate some great national scheme, by which the laboring classes of this country may obtain sufficient work to enable them to provide, first, food and clothing for the body.

I know it is an old and trite saying that cleanliness is next to godliness, but a full stomach and comfortable raiment are better still, and are, in my opinion, far more conducive to the happiness and health of a people than all the baths in the world.

MECHANICAL FILTRATION.

By W. P. Mason, Professor Department of Chemistry, Rensselaer Polytechnic Institute, Troy, N. Y.

Having been intimately acquainted with the extended experiments conducted under order of the United States court at the Elmira filtering plant during June, 1897, it occurs to me that sundry observations made during the test might be of interest to this association. For the information of those unacquainted with the type of mechanical filter used at Elmira, let it be said that each filter (of which there are eighteen in the battery) consists of a wooden tub 13 feet 6 inches in diameter and 14 feet high, and open at the top.

The bed of filtering sand, 3 feet 6 inches

deep, together with the washing machinery, occupy the upper portion of the tank, leaving below an empty chamber 6 feet high, through which the raw water must pass on its way toward the sand.

To discover just what this lower chamber would do in the way of relieving the filter proper of a portion of its work, was the reason for instituting the test. It would be proper here to state that the dose of alum had been added to the water before the chamber in question was reached, and also to observe that the water entered the chamber in a tangenital direction, near the circumference of its circular bottom, and flowed away through a pipe in the center of its roof.

Such an arrangement naturally caused the water to take up a movement of rotation, more or less coincident with the surface of a cone whose base was the floor of the chamber and whose apex was the orifice in the center of the roof. Timbers supporting the sand layer above naturally interfered with the uniformity of this motion.

It was not denied that coarse and heavy material, such as sand, would be retained by the chamber, but there were those who held that flocculent aluminum hydrate, with its entangled or "coagulated" material, was much too light to settle to any material extent under the conditions obtained.

As a result of the seven days' trial run, with an average of 10,731 gallons of water passing through each filter per hour, a number of interesting observations were secured, showing that the chambers in question certainly fulfilled a useful function and did relieve the filters to a material degree.

Upon opening the chambers at the end of the seventh day a large quantity of aluminum hydrate was, in every case, found lying upon the floor in forms like drifted snow and varying in depth from almost nothing near the circumference to 14 inches and more toward the center of the bottom. It was impossible to calculate the volume of these drifts, but it was plainly equivalent to many cubic feet.

It was proposed to determine the purification value of this apparently large precipitation by catching it in a filter press and subsequently weighing it, after drying. This was accordingly done with the sediment from one of the tanks, with the result that the large volume of coagulated material made a very indifferent showing when translated into weight. It was, and still is, however, my strong opinion that volume, not weight, is the important factor to be considered when dealing with this precipitate.

It must be admitted that the material forming the sediment banks in the Elmira tanks was very light, but it was heavy enough to fall, or else it would not have been there; and, provided it be heavy enough to fall, it is certainly true that the greater its bulk for a given weight the better will be its efficiency, for it will cover so much the more space while falling, and thereby increase the chances of entangling suspended impurities during its formation and descent.

Rain drops falling through the air carry down impurities, of course; but if transformed into flaky snow, their purifying action is much increased, although their specific gravity is lessened.

It is for these reasons that I think the relative efficiency of the chamber below the sand bed should be measured by the volume of the retained preciptatate rather than by its weight.

The photographs scarcely show one other feature of these aluminum hydrate deposits, which to me was of considerable interest, namely, the numerous ball-like aggregations occurring throughout the mass. It would seem that the hydrate had in many places been rolled together and built up much after the same manner that a boy accomplishes the gradual enlargement of a ball of snow. This formation I believe to have resulted from the rotary motion given the water by the special device for its introduction already alluded to. Motion such as that is, in my opinion, decidedly favorable to the formation of large flocks in a liquid in which aluminum hydrate is already formed. Certainly it is a mistake to suppose, as has been so often maintained, that the most rapid "coagulation" and precipitation of the hydrate is to be secured by permitting the liquid containing it to remain in a state of complete rest. The photographs shown herewith illustrate that gentle rotary motion, far from being objectionable, is a distinct advantage. The two jars here shown differ from each other but in the fact that the left hand one had its contents gently rotated, while the contents of the companion was maintained at complete rest. In each the same quantity of hydrate had previously been formed. The photographs show how progressively advantageous was the rotary motion for the formation and deposit of large flocks of the hydrate; nor is this to be wondered at when one considers that the movement in question furnished opportunity for more frequent collision, with resulting adhesion, of the growing flocks. As already stated, the evidence of such action on the large scale in the Elmira tanks was very pronounced.

With reference to the bacterial efficiency

of these tanks, it was interesting to observe that an average of 42.6 per cent. of all the germs present in the raw water had been removed by the time the sand was reached.

Finally, a word with regard to the claim so often advanced that a closed pressure filter, operating without a chamber between it and the point of introduction of the alum, does not act as a surface strainer, but that the deeper portions of the sand bed have their parts to play in the work of purification as well as the surface layer.

This claim I found to be perfectly true. By tapping such a filter at points both above and below the sand surface I was enabled to secure samples of water from various depths in the sand body.

Analytical results showed that the alum was not entirely decomposed, and, consequently, the chemical equation not fully satisfied until considerable depths in the sand bed had been reached.

This was to have been expected, in view of the fact that time is an element in all chemical reactions, and a pressure filter, running under the conditions named, allows but small time to elapse after the addition of the alum until the sand is reached.

As a corollary to this proposition, the tanks we have been discussing must also serve as reaction chambers, permitting of complete decomposition of the alum, and such I found them to be upon further investigation.

AN OIL FILTER FOR BOILER FEED WATER.

By Dabney H. Maury, Jr., M. Am. S. M. E.

The main steam pumping plant of the Peoria water company consists of three Worthington compound condensing duplex vertical high duty pumping engines of 7,200,000 gallons daily capacity each, against a pressure of about 135 pounds; with six Heine water tube boilers of 200 H. P. each, or 1,200 H. P. in all; and the necessary boiler feeders, air pumps, jacket pumps, dry well pumps, air compressors, electric light engine and dynamo.

The pumping engines are rated at 100,000,000 ft. lbs. per 1,000 lbs. of steam. Usually but one pumping engine, with the necessary auxiliaries, and two boilers, of a total of 400 H. P. are in use at a time, the time of actual pumping averaging seventeen hours per day.

In May, 1896, the writer made a test of this entire steam pumping plant under ordinary working conditions, with a view to determining the lines on which improvements could be made in its operation. A description of this test was presented as a paper before the Illinois Society of Engineers and Surveyors at its Springfield meeting in 1897. I quote the following from that paper:

"In the light of the information furnished by the tests the changes were made in the feed-water return system. It was considered of first importance to diminish the deposition of scale and oil in the boilers. To accomplish this, the writer decided to use as much condensed steam, and as little fresh feed water as possible; to separate the oil from the condensed steam (which has no scale-forming ingredients, and to remove the carbonates and sulphates from fresh-feed water (which has no oil), treating the two separately before allowing them to mix in the boilers. * * * A trial showed that the emulsion of the oil and the water could not be separated by gravity. Arrangements are now made to remove as much of the oil as possible by filtration. A portion of the oil in the exhaust steam from the auxiliaries is removed by the Austen separator set on the exhaust pipe line from these pumps to the hot well.

"The fresh feed water * * * is forced by the pressure in the mains through a 50 H. P. Hoppes live steam purifier, purchased for the purpose, which removes a considerable portion of the salts of lime and magnesia. The advantage of treating the fresh condensed feed-water separately will be apparent when it is remembered that if all the feed water had to be treated to remove the salts a purifier of 800 H. P. would have been required to do the work now done, and with a margin to spare, by the one of 50 H. P. * * * A small Crown meter measures the fresh feed-water before it goes to the purifier. This little meter plays an important part in the economical operation of the plant, for an excess in its registration during any man's watch means negligence, and each man is encouraged to reduce the meter readings to a minimum. Leaks that formerly went undetected for long periods, owing to the very large number of pipes and valves in the system, are now promptly discovered."

As will be seen from what I have just quoted, which was written in the latter part of 1896, no serious difficulty was anticipated in filtering the oil from the condensed steam. But before satisfactory results were reached we learned that the problem was not so simple after all.

The condensers are of the surface type, and the air pump which returns the condensed steam from them to the hot well was already pumping against almost as great a

head as it could manage, so that it was not feasible to add enough to its load to enable it to force the water through a pressure filter, so it was decided to employ the gravity type.

Having decided to employ gravity filters it was of course deemed desirable to avoid the use of coagulants.

As the condensed steam was absolutely pure, except for oil, and as a large part of the scale-forming impurities in the very small proportion of fresh water used would be removed by the live steam purifier, some method of removing the oil from the condensed steam was all that was needed to make an almost perfect feed-water, with all the blessings attendant thereon.

The first filter tried was a thirty-inch galvanized iron tank with perforated bottom, which was conveniently set over a reservoir connecting with the hot well. This tank contained about one foot in depth of sponges, held between the meshes of a pair of strong wire gratings. These gratings could be squeezed together or loosened, by a bolt and nut, and the filtration could be made fast or slow as desired. The sponges did not seem to catch much oil, so cotton waste was tried instead, with no better results. After this, straw, hay, excelsior and coarse cloth were tried in turn, and while the rate of filtration required to get all the condensed steam through the small filter area was unquestionably too rapid, the results gave no encouragement, and the oil caught would hardly have sufficied to grease the proverbial gimlet.

For those who may desire to look into the subjects of oil in feed water and of oil filters the following references are suggested: Transactions Am. Soc. Mech. Eng'rs, Vol. XIII, pp. 248 to 258; Vol. XIV, pp. 118 to 146; Vol. XVII, pp. 295 to 315, and Cassier's Magazine, October, 1897, "Marine Feed Water Filtering," by Nisbet Sinclair.

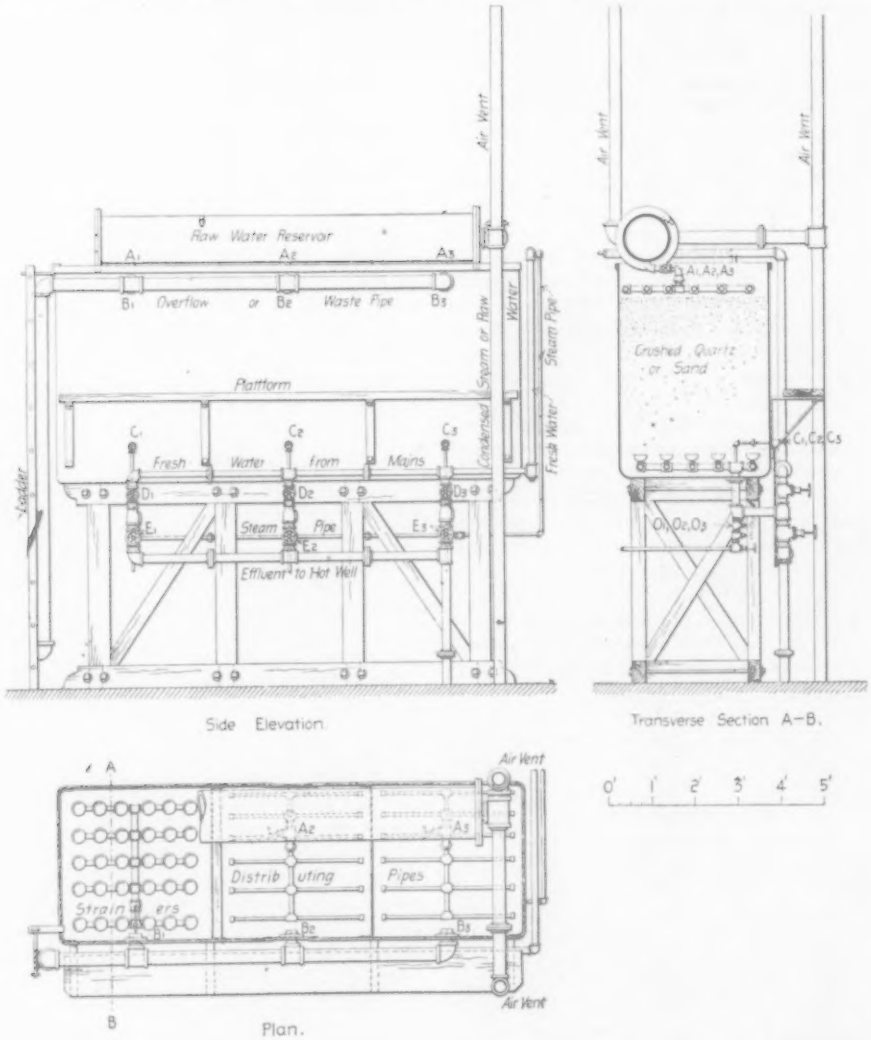
All this time we were taking well-meant advice from our friends, and the prescriptions were as numerous as those described by Mark Twain in his famous chapter on membranous croup, there being one point of resemblance in them all—their failure to afford relief. At last, however, a filter man told us of a certain steam plant in which the boiler fed water, consisting principally of condensed steam, was simply filtered through coke and sand without coagulants and with good results. An investigation was made of this plant, and it was found that while the constructing engineers had indeed designed the filters to be operated without coagulants, the man employed to operate the plant sometimes used alum and sometimes did not, and could give but little information as to the results in either case. The general impression gathered by us, however, was that the rate of filtration was too rapid, and the effluent was not very different in appearance from the raw water. Nevertheless, our next attempt was with coke and sand as filtering media, and for the first time there seemed to be some prospect of success. A couple of old cocoanut-oil tierces were fitted with the necessary inlet pipes, strainers, outlets, valves, etc., and into one was placed about four feet in depth of screened sand, while the other was charged with one foot of powdered coke on top of three feet of sand. The effluent from these crude filters seemed slightly better than the raw water, but the improvement was hardly noticeable. The results seemed to show, however, that a much slower rate of filtration might be successful, so a sand filter consisting of three compartments, each of twice the area of one of these tierces, was designed and ordered built.

About this time the writer, still in search of light on the subject of oil filters, put into the question box at the Denver meeting of this society a request for information as to the best method of removing oil from condensed steam for boiler feeding. My query was not answered, except that after the meeting I was told by an authority on filters that the only way to get rid of the oil was to use a coagulant, putting into the already softened water enough lime to precipitate the alum.

After my return from Denver the new filters were finished and were put in operation Aug. 29, 1897. They have been in service ever since. The accompanying photograph show their construction. No especial claim is made for originality, as the general arrangement of valves and piping is similar in many respects to that commonly seen in mechanical filters, but it seemed to the writer that a complete record of the results of an experiment which was so successful in our case might be of interest to other steam users who are troubled with bad feed water.

A steel tank is divided into three equal compartments, known respectively as filters Nos. 1, 2, and 3. All three filters are generally used at once. When one requires cleaning it can be shut out and cleaned without interrupting the use of the other two. The area of each filter is about 12.25 square feet. Filter No. 1 contains crushed quartz, while filters Nos. 2 and 3 contain screened sand. The depth of quartz and sand in each filter is about 3 feet 6 inches. The raw water is raised by the air pumps from the condensers through the 3-inch pipe

at the right of the tank into the 12-inch cast-iron distributing pipe over the filters. This water is freed from air by the two risers shown. Three 1-inch valves, A1, A2 and A3 admit the raw water through a gridiron of perforated pipes, to the top of the sand. In the bottom of each filter are thirty strainers connected to



used to wash the filters, while 01, 02 and 03 are ¾-inch valves on the steam line used when necessary for heating the wash water. Plugs in the 3-inch line at B1, B2 and B3 are employed instead of the more costly and cumbersome valves for opening or closing the overflows or wastes from the filters while washing. The overflow or wash water

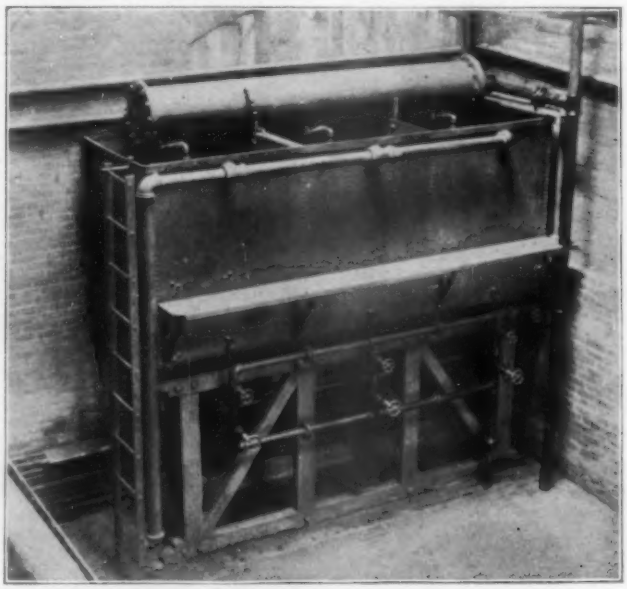
the 2-inch outlet pipe. These strainers are simply brass cups threaded at the bottom with ½-inch male pipe thread, and covered on top with fine brass wire gauze stretched and soldered, for strength, over heavier wires, which in turn are soldered to the cups. The 2-inch valves E1, E2 and E3, regulate the outflow from the filter to the hot well. The 1½-inch valves, D1, D2 and D3, control the clean water from the city mains runs out through the pipe on the left of the tank to the sewer. While washing the sand is from tome to time stirred with a hoe or paddle. For taking samples of the effluent, while the filters are running, the ¼-inch angle valves, C1, C2 and C3 are provided. These valves control ¼-inch pipe lines tapped into the outlet pipes inside the filters and terminating at their outer ends just below and behind the effluent pipe line. To

take a sample from Filter No. 1, for instance, the 2-inch outlet valve E1 is closed, and the ¼-inch angle valve C1 is opened and the water flowing from the quarter-inch pipe is caught in a bottle or other suitable vessel. The tank is supported on a framework of oak resting on concrete foundation. A steel ladder gives easy access to the board platform from which the upper parts of the tank can be readily reached.

Before this filter was put into service and during the period in which we were trying to use as much condensed steam as possible instead of fresh water, the oil in our boilers was giving constant and very serious trou-

Below follows a detailed statement of the condition under which the filters and the boilers were operated:

1. Period covered, August 29, 1897, to May 31, 1898, 276 days.
2. Actual time pumps and filters were running, 4,695 hours.
3. Approximate total evaporation of feed water by boilers, 38,383,000 lbs.
4. Approximate total fresh water, 3,518,000 lbs.
5. Approximate total condensed steam, 34,865,000 lbs.
6. Percentage of fresh water in total feed water, 9.2 per cent.
7. Percentage of condensed steam in total feed water, 90.8 per cent.
8. Analysis of fresh water.



OIL FILTER FOR BOILER FEED WATER.

ble. The lowest row of the tubes in each boiler buckled up from four to seven inches and leaked almost without exception. It was necessary to shut down at least once a week and swage up and frequently to renew the tubes in this row. There was little or no scale in the boiler, but a brown, gummy or viscous coating was found, especially near the bottom of the rear water leg and in the lower tubes. Since August 29, 1897, the record is very different. There has never been a shut down to repair a boiler, and no new tubes have leaked. Boilers are kept under steam constantly day and night from two to four months, and when opened show only a soft scale of a maximum thickness a little greater than that of blotting paper. These boilers could just as well have been run several times as long without being opened.

Nitrate of potasium.....	.617 grains per gal.
Nitrate of sodium	.294 grains per gal.
Chloride of sodium	2.598 grains per gal.
Sulphate of sodium	2.407 grains per gal.
Sulphate of magnesium..	3.213 grains per gal.
Carbonate of magnesium	.205 grains per gal.
Carbonate of calcium ...	15.917 grains per gal.
Oxides of iron and aluminum	.046 grains per gal.
Silicic acid	.840 grains per gal.
Total	26.137

Water is remarkably clear and contains nothing in mechanical suspension.

9. Hardness of fresh water, 20 degrees by Clarke's scale.

10. Kind of oil used in cylinders, Kellogg's opaque anti-corrosive cylinder oil.

11. Total cylinder oil, fed into main engines, 48 gallons, equal 192 quarts, equal .7 of a quart per day.

All of this oil went into the engine cylinders and passed thence through the con-

densers to the filters, except such oil as may have been caught by the condensers.

12. Total cylinder oil fed into auxiliaries, 46 gallons, equal 184 quarts, equal .67 quarts per day.

An unknown proportion of this oil was removed by the Austen separator on exhaust pipe line from auxiliaries to hot well and did not get into the boilers.

13. Average temperature of condensed steam entering the filters from the air pumps, 56 degrees Fahrenheit.

This low temperature is due to the low temperature of the condensing water (50 degrees Fahrenheit) and to the large area of condensing surface. The water generally leaves the filters several degrees warmer than it enters.

14. No. of washings of filters in 275 days:
Filter No. 1, 11 washings.
Filter No. 2, 9 washings.
Filter No. 3, 11 washings.

15. Average number of days each filter ran without washing, 26.7 days.

16. Time consumed in washing as follows:
Water is allowed to run slowly from the city mains with as little steam as necessary for about 1½ hours. The sand is stirred at intervals for a few minutes at a time. The washing is done by the regular fireman on duty at the time.

17. Area of each filter, 12.25 sq. ft.

18. Combined area of all three filters, 36.75 sq. ft.

19 Depth of sand or quartz, 3 ft. 6 inches.

20. Rate of filtration:
In lbs., per hour, 7426.
In gals., per hour, 89.5.
In cubic feet per hour, 11.88.
In gallons per acre, per 24 hours, 2,546,024.
In vertical inches per hour, 3.87.

21. Cost of filter for concrete foundation, oak frame, steel tank, screened sand, crushed quartz and such pipes, valves and fittings as were not in stock, $135; estimated value of material used from stock, $55; total, $190.

N. B.—The most of the pipe-fitting was done by the regular pumping station crew; all other labor is included in the first item of $135.

22. Repairs to boilers since filters have been in service, none.

23. Repairs to filters, none.

24. Annual saving in boiler compound, $175.

25. Estimated annual saving in coal, due to absence of oil and scale, 10 per cent. of coal bill, $400.00.

N. B.—There is also a large annual saving in repairs to boiler and in boiler cleaning, but the actual amount of this is difficult to estimate.

Observations of the working of the filter show that at first, after cleaning, the filtration is not as thorough as after the filter has been running a few hours. This is doubtless due partly to the fact that the sand is loosened up by the washing and requires time to settle again and close the voids, and partly to the fact that the film of oil formed over the top of the sand after the filter has been running a short while materially aids the filtration. It was difficult to tell whether the sand or the quartz was the more efficient filtering medium, but it is believed that the best results under equal rates of filtration were obtainend from the quartz. In every instance, however, it was noted that slower filtration increased the efficiency of the filter. Before making this filter the writer made inquiry of several prominent filter men and was informed that no patents would be infringed by its construction, and if this account of our experience should lead to the use of some similar device by any fellow-sufferer from the evils of bad boiler feed-water, the writer will feel amply rewarded for the time and labor spent in the preparation of this paper.

THE QUESTION DEPARTMENT.

[By Charles Carroll Brown, M. Am. Soc. C. E., for MUNICIPAL ENGINEERING.]

REPAIR OF ASPHALT PAVEMENTS.

We have a little over a mile of Trinidad sheet asphalt pavement in this city, which has been laid seven years. Does any one make a small outfit for making repairs? We need only a few yards at a time. Do other cities make their own repairs? We must pay a contractor $3 a yard for making repairs.

F. E. C., Amsterdam, N. Y.

The advertising pages of MUNICIPAL ENGINEERING give the names of makers of machinery for mixing asphalt for pavements. Probably the smallest plant possible for good work was used in laying your pavement, and it would be necessary for you to purchase a plant of nearly the same size for your repairs. It takes experts to run the plant also. The plant will deteriorate rapidly and require frequent repairs. Clearly it will be less expensive to have your pavements repaired by the contractor at $3 a yard than to do it yourselves. You will also get better work. No city has yet run a re-

pair plant of its own long enough to demonstrate its success. Only large cities with enough repairing to keep a plant reasonably busy can afford the luxury of owning their own plants. It is possible that such cities would find them economical, but this has not yet been fully demonstrated.

MIXING ASPHALT FOR PAVEMENTS.

Kindly give the names of firms that manufacture portable asphalt plants.

Is there any book published treating on mixing of asphalt for pavements?

J. Bristow, Narragansett Pier, R. I.

In the advertising pages of this magazine will be found descriptions and pictures of the portable asphalt paving plants, manufactured by the principal makers of such apparatus.

No book is published giving the details of methods of mixing asphalt for pavements. The later books on pavements and the ordinary specifications give the ingredients and their proportions within limits, but describe processes only in the most general way, or do not describe them. Differences in materials make such differences in mixtures that experienced men are required to produce the best results. The art can not be learned from books. The pages of MUNICIPAL ENGINEERING contain more information on the subject than can be obtained elsewhere in printed form.

THE BEST SIZE OF PAVING BRICK.

Which give the best results for brick paved streets, paving blocks, as they are called, say 4x4x9, or brick, size of common building brick, say 2x4x8?

O. C. Breed, Fulton, N. Y.

The size of blocks within the limits mentioned does not make so much difference as the character of material, method of preparation, particularly mixture and burning, and method of laying. Brick manufacturers seem to prefer the smaller sizes, perhaps because it is more difficult to burn the larger sizes thoroughly and uniformly, and there is likely to be more waste in the kiln. Such imperfect or poorly burned blocks can not be disposed of so readily for other purposes, so that the blocks may cost a little more per square yard than the bricks. Theoretically, with homogeneous material, uniformly burned, the larger blocks would produce a pavement which would remain smooth longer, and this is practicably attainable. Too wide a block is objectionable on account of difficulty in burning, and on account of less satisfactory foothold for horses. The difficulties in burning increase very rapidly after the thickness becomes more than 2½ to 3 inches. The writer's experience with blocks 3x4x9, and with bricks of the same manufacture, 2x4x8, laid under the same specifications, is in favor of the larger size. The same is true in case of all good blocks with which he has had experience.

AN INEXPENSIVE CEMENT TESTING MACHINE.

Could you suggest a design for an inexpensive cement testing machine, such as any mechanic could construct?

C. V. Kerch, Dixon, Ill.

A simple testing machine can be made of a wooden lever about ten feet long, supported by a steel pin on two uprights, set 20 inches from one end. On the top of the lever is laid a track of light T iron, on which a wheel supporting a weight runs. The pin holes in the lever and its supports are reinforced by iron washers. The lever can be graduated in feet and inches. The dimensions of the lever depend on the stresses required to be generated. Clips for holding bri-

quettes are fastened near the short end of the lever and directly opposite on the base. The accuracy of the results obtained depends upon the care with which the machine is constructed and experience with its use. The machine can also be used for shearing and for measuring compressive strains. It is very inexpensive. A more elaborate and accurate machine can be constructed for ten or fifteen dollars. Accurate results depend so much upon the proper apparatus for preparing test pieces and for holding them in the machine, that the comparatively small additional sum necessary to purchase a standard machine is well invested, repaying itself in the added confidence felt in the results.

DEPRECIATION OF A WATER PLANT.

Can you refer me to any articles or pamphlets on the depreciation of a water plant? I would like to know what amount or percentage should be fairly charged for depreciation on each of the following items: Pumps, boilers, buildings and mains. *O. M. L., Wilkes-Barre, Pa.*

The rate of deterioration of the various items mentioned depends so largely upon the character of the first construction, and upon the local conditions and care taken of the machinery, that there has been no systematic attempt to deduce an average depreciation for the separate items. The life of water pipe is estimated at twenty to sixty years, with an average of about thirty years, some engineers, however, claiming that no good water system in this country is old enough to have reached the limit of the life of first-class cast-iron pipe. A general idea of the annual depreciation of the plant, as a whole, can be derived from a study of the maintenance, renewal and repair accounts if they are kept in sufficient details. Mr. E. Kuichling discusses this subject in his report to the Executive Board of Rochester, N. Y., an abstract from which is printed in MUNICIPAL ENGINEERING for October, 1897. On page 211 of that number, he concludes that an annual payment of two per cent. of the cost will produce a fund sufficient to renew the works or to pay off the original cost in 30 years, the assumed life of the works. On page 150 of MUNICIPAL ENGINEERING for September, 1897, is a brief notice of a report by the City Engineer of Los Angeles, California, of the present value of the plant and the amount of deterioration in it (practically a gravity plant). Detailed figures are not given in the report, nor the average age of the plant. The indications are, that the observed deterioration is not far from one per cent. a year, but this takes no account of the annual payments for renewals, there being no reports of such expenditures made by the company. The character of material used and the local conditions are such that there is little question that the actual total deterioration equals or exceeds two per cent. a year.

The city engineer of Omaha, in a report on the water-works made in 1896, assumed one per cent. a year as the average deterioration in excess of the annual expenditure for removals and repairs, there being the same lack of detailed reports of such expenditures. A discussion of the relative economy of steel and iron pipe, made by an engineer on the Brooklyn water-works, gives details of experiments tending to strengthen the basis for assuming a total annual deterioration of two per cent. so far as pipe is concerned. This paper, by I. M. De Varona, is printed in the proceedings of the American Water-Works Association for 1894. When the

works at Haverhill, Mass., were purchased by the city in 1893, the total annual deterioration was estimated to average two per cent. Mr. F. C. Coffin estimates the life of water pipe at 35 to 40 years. A fund produced by annual payments of 1.5 per cent. of the cost, placed at interest at three per cent., would produce this cost in thirty-seven years. In a system requiring pumps, deterioration of other portions of the works, and even of pipe, is more rapid, so that this figure must be increased to the two per cent. named by Mr. Kuichling. If water-works accounts were kept in sufficient detail this subject could be studied with more ease, and more definite results could be obtained. If any of our readers have reports of actual observations we shall be glad to publish them.

BOOKS ON COMPUTATION OF CUBIC YARDS.

Would you advise me where I can get a ready reckoner, or book of some kind for computing cubic yards, perches and other measurements? *A. S., Lancaster, Pa.*

Among books of this kind are Haswells' "Engineer's Pocket Book," $4; Trautwine's "Engineer's Pocket Book," $5; Molesworth's "Engineer's Pocket Book," $2; Hurst's "Engineer's Tables," pages 1½ by 2½ inches, 40 cents; in case, 50 cents. These are probably arranged in about the order of their value to the inquirer. MUNICIPAL ENGINEERING CO. can supply them.

INFORMATION ABOUT DISPOSAL OF GARBAGE.

We want information regarding disposal of garbage. To what can you refer us that will help us in our study?
H. H. Pratt, Brookfield, Mo.

A number of articles on various parts of the subject have appeared in MUNICIPAL ENGINEERING. Among them are the following: 1895, p. 301, June; p. 103, Aug.; p. 225, Oct. 1896, p. 56, Jan.; pp. 199, 201, Mar.; p. 94, Aug.; p. 167, Sept.; p. 377, Dec. 1897, p. 378, June; p. 295, Nov.; p. 348, Dec. 1898, p. 44, Jan.; p. 367, June. The supplement to the June number of *Municipal Affairs*, reviewed in another column, is a valuable report of actual experience; price, 50 cents. Among books treating in part of this subject are "The Cleaning and Sewerage of Cities," by E. Baumeister, $2.50. "Sanitary Engineering," by H. P. Brunois, $6; "The Disposal of Household Wastes," by W. P. Gerhard, 50 cents. MUNICIPAL ENGINEERING CO. can supply any of them.

RELATIVE MERITS OF BRICK AND CEMENT SIDEWALKS.

I would like your opinion as to the relative merits of brick and cement sidewalks. Can you give me the names of firms who make paving brick for sidewalks?
A. H. M., Goodland, Ind.

In regard to cost, a good brick sidewalk can be laid for say one-third to one half the cost of a good cement walk. Though the cement walk is practically indestructible, on the ordinary residence street or even business street in a small town, a brick pavement can be renewed as often as necessary on the interest of the excess in cost of the cement walk. As to color, the brick walk is more satisfactory to most persons. With a light rain, the bricks absorb the moisture, while on the cement walk a slight film of water forms, making it more likely to wet the dresses and thin shoes of ladies. On the other hand, well-laid cement walk is in place for an indefinite period. If not too white it forms a pleasing contrast to grass, trees and pavement; if laid with sufficient slope pools of water do not form on it; there is no unequal settlement, nor are

there loose bricks to make the walk uneven or perhaps dangerous. A cement walk is perhaps more frequently slippery in winter, but the surface is uniform, so that falls are not so frequent. Some consider the effect of cement walks upon trees to be injurious. Careful observation leads to the conclusion that the injury, when there is any, is done by careless treatment of the roots of trees in preparing the ground for the pavement, and that the subsequent effect of the pavement upon the trees is inappreciable.

As to makers of sidewalk brick, the advertising pages of MUNICIPAL ENGINEERING give the names of many makers of street-paving brick, many of whom make special forms of such brick for sidewalks. Every kiln of first-class building brick has a certain proportion of bricks which are burned hard enough to answer for ordinary brick pavements at less cost than the shale bricks and with the saving of freight in most cases. Walks with large foot traffic should have the harder brick.

CITY APPOINTEES EXEMPT FROM CIVIL SERVICE RULES.

The state law explicitly says: "The heads of departments shall be exempt from the operation of this (the civil service) law." The fire, water and street departments are in charge of a board who appointed a street superintendent to take charge of the street department. The local civil service commission claimed that the appointment must be made from an eligible list prepared by them after an examination, while the appointing board claims his exemption from examination as the head of a department. Can you give us some light on the question?

W. F. F., Rochester, N. Y.

The details of the administration of most of our American cities have been determined upon in a manner so entirely without coherent plan, as custom and the immediate requirements of each case seemed to demand, that in most instances it is difficult to define what is meant by a department. In one sense of the word the board having charge of the three departments mentioned are the heads of these departments (or this department), and so are, strictly speaking, the only persons in them (or it) who are exempt from the supervision of the civil service commission so far as appointment to office is concerned. That this is not the accepted definition of "head of department" is evident from the fact that the civil service commission exempts from examination certain employes of the board who have duties of such importance and of such nature that they may be considered as heads of departments. Some of them would not be so considered, however, in such cities as have properly coordinated the various departments of city service and definitely and logically fixed their boundaries and the duties of their heads.

So long as there is no competent legal definition of the terms "department" and "head of department," it should be perfectly proper for the civil service commission to carry out the provision in its rules stating that any new office will be considered as belonging to the class requiring examinations unless otherwise decided by the commission itself. In the absence of exact definition, there must be some body or officer whose function it is to make the decision in case of each office, and the law seems, by implication at least, to delegate this power to the civil service commission. If it were otherwise, evasion of the civil service law would be comparatively easy, new departments being created as rapidly as necessary. This mode of evading the law has been declared illegal in Illinois, and may be the same in

other states having statutes concerning municipal civil service. If the civil service commission is arrogating too much power to itself, the matter can be brought to a prompt decision in the courts by a refusal to follow its requirements, a refusal to pay the salary of the appointed officer and a suit to collect it. The duties of the street superintendent are not defined in the question and it is impossible to say whether he is the head of a department or the head of a subdepartment, or even the head of a section of a sub-department.

The general principle upon which the city work should be divided into departments and the departments definitly defined, is developed in the charters of St. Louis and Greater New York with fairly close adherence to a logical plan. In the city of Rochester lines of work which have little connection are grouped under a single board or department, in some cases, while in others, work which belongs to a single department is distributed among several departments, boards, or commissions. The definition of department in that city is, therefore, more than ordinarily artificial, and there is special need of an authority to interpret the definition in each special case.

BY WAY OF COMMENT.

Ethics in Engineering.

At its last meeting for the season the Engineers' Club, of St. Louis, considered the subject of engineering ethics, and the discussion was of interest as much for the indications of what was not in the minds of the speakers as for the points actually considered. The paper of the evening considered the subject in the line of the general definition of ethics as "the science which treats of the nature and grounds of moral obligation and of the rules which ought to determine conduct in accordance with this obligation," but others who discussed the subject confined themselves to the more restricted definition, wishing to consider or to deny the desirability of "a particular system of principles and rules concerning moral obligations and regard for the rights of others, whether true or false." Underneath the expressed thought of nearly all was apparent the fear that a fixed code of ethics would be based on a false system. To one speaker the question of schedules of fees seemed to be the most important branch of the question; to another, determination of the qualifications of practitioners; another wished to bear strong testimony to the fact that the standard of personal honesty was higher in the engineering profession than in any other walk of life; another wanted a specific code to discuss; and another acknowledged the lack of instruction of engineering students in ethics, but would apparently restrict such instruction to talks on honesty, uprightness of purpose, morality in general. The subject is evidently one of many sides, of which each speaker had heretofore seen but the one which appealed

most directly to him. A point in the paper on which particular emphasis was placed was just this lack of knowledge of the subject among engineers, the lack of professional esprit and the consequent lack of coherence in the engineering profession, which is still further affected by the modern necessity for specialization. Frequent and free discussion of the various phases of the subject of ethics would tend to unify the profession by giving its members common ground of interest and discussion and a rallying point from which a view of the relations of the profession to the business world, and the necessity of closer organization can be obtained. The necessity of a broader education as a foundation for professional work as a corrective for the narrowing tendency of the excessive specialization now called for was also emphasized. The discussion demonstrated the fact that the subject is one upon which the engineers of St. Louis have expended very little thought and that full consideration of it would be of great benefit whether it led to definite action of any sort or not.

Denver and New Orleans Water-Works.

The water company of Denver, Colo., has offered the works to the city at a price which is reported to be approximately $9,000,000. This is a case in which it would probably not be equitable to apply the method of valuation based on the earning capacity of the works, unless the water rates are higher than in other cities in the same proportion that the cost is higher. Neither would it be satisfactory to base the purchase price on the original cost, with allowance for deterioration, unless ample allowance is made for constructions, which have been abandoned or found to be inadequate. On account of the natural conditions the supply of water to the city is somewhat more expensive than the average, so that possibly a proper figure for the works would be one based on careful estimates of the cost, at the present time, of constructing the existing working plant and the cost of constructing a new plant fully adequate for the needs of the city. The works have been manipulated in the past in much the same manner as the works at Omaha, in part by the same persons, and with similar results, so that the amount of stock and bonds oustanding bears little relation to the actual cost of the works, and still less to their real value. Nine million dollars is a large figure for waterworks for a city the size of Denver, even with the extra first cost there necessary, and careful examination by engineering and financial experts should be made before the city pledges itself to pay that sum.

The public press of New Orleans is also agitating municipal ownership. The water-works are inadequate for the supply of a city one-fourth the size, and the quality is poor, as the supply is taken from the Mississippi river without prop-

er treatment, and where it is subject to pollution from the refuse of miles of docks and levee with their shipping. The works are said to pay a reasonable interest on $2,000,000. If the city is unable to secure the works at a valuation approximating the actual value of the plant, and can secure them at something like this figure, it will be true economy to purchase the works, even though it will be necessary at once to establish a new pumping station, purchase new machinery, and rapidly extend the pipe system. The latest reason for demanding an adequate and healthful supply is the report that New Orleans was abandoned as one of the points for concentration of troops on account of the unsatisfactory water supply. This, if true, cuts off from the city a revenue which would go far, during the time it lasts, towards paying the interest on the cost of an adequate plant. New Orleans and San Francisco are now the only cities of 250,000 or more which do not own their water-works.

Licensing Architects and Engineers.

Illinois is the first state, says *The Technograph*, to enact a law requiring every practicing architect to obtain a license from a board of examiners. That journal, a semi-official organ of the University of Illinois, is of opinion that the law will be of great benefit to the public, as it protects citizens from injury or loss by incompetent architects, and to the profession, especially the younger members, because it insures that practicing architects shall have scientific knowledge and technical training. The law tends to raise the average of technical attainments in the profession rapidly. The state of Illinois assumes the regulation of many trades, such as plumbers and even horse-shoers, and of professions, such as medicine and architecture, but has not yet touched the profession of engineering. So far, the legislature has refused to license surveyors. As the need for engineers increases, and the necessity for high technical attainments is better recognized, the people will take up the regulation of engineering as it has the others, unless engineers themselves take up the matter and guide the course of events. The state has a right to regulate the practice of engineering, so far as it relates to public work, and in some states this is done, not by licensing engineers, but by requiring them to submit their plans for public work to a competent board, such as the state board of health, for sewerage and water supply. This process does not cover all lines of public work; for example, the regular work of a city engineer, but so far as it goes is a good step in advance. Others will follow until the people consider themselves protected against their own ignorance and unconcern. If engineers wish the matter to be disposed of in a manner entirely satisfactory to themselves they must take the first steps and carefully guide the legislative hand.

Street Cleaning.

Municipal Affairs, the quarterly publication of the New York Reform Club Committee on Municipal Administration, issues a large supplement with its June number, giving a report upon the methods and results of street cleaning and garbage disposal in the city during the years 1895, '96 and '97, being the report to the mayor by the commissioner in charge of the department.

A report of his observations in European cities is made by George E. Waring, Jr., and the remainder of the book is taken by the reports of his subordinates in the work in the city of New York. Two-thirds of the book gives a general view of the methods of garbage disposal in use in European cities, and considerable detail of the methods in use in New York during the period covered by the report, with full estimates of the cost of various steps, and the salvage resulting from several operations upon the city's refuse, including use of swill, preparation of fertilizers, waste paper traffic, treatment of ashes, etc. This portion will be a valuable handbook upon the subject. While most of the work described is done under peculiar conditions in New York City there are many details which would be valuable in other large cities and in many smaller municipalities.

One article gives an interesting discussion of the cost of cleaning streets. The cost of cleaning asphalt in good condition is assumed at 100. The cost of cleaning pavements of other materials in good condition; pavements in good, fair and bad condition; with light, medium, heavy and dense traffic; with various kinds of rails for street cars; with elevated roads; privately sprinkled; with various classes of population, is estimated. On account of the practical impossibility of separating these various items in practice to determine their effect upon the cost by actual observation, the relative effects of these various conditions were estimated by the eleven district superintendents and the average of their estimates was assumed as the measure of the relative difficulties of cleaning streets. These estimates give the actual results in practice. If, for example, granite and Belgian block pavements were kept as clean as asphalt the relative cost for asphalt, granite and Belgian would be 100, 200, 220 instead of 100, 150, 160 actually used for the actual conditions of cleaning. The averages are:

For kind of pavement:

Asphalt 100.
Granite 150.
Belgian 160.
Brick 100.
Wood (Smooth Karri) 100.
Cobble 400.

For condition of pavement:

Good 100.
Fair 120.
Bad 140.

For amount of traffic (number of vehicles per hour on 30-foot street as given):

Light 25 or less, 100.
Medium 25 to 100, 140.

Heavy 100 to 150, 180.
Dense 150 to 300.

For kind of rail for street cars.

None 100.
Flat 110.
Grooved 110.
T rail 120.
Steam 140.

For condition of pavement between tracks:

Good 100.
Fair 110.
Bad 120.

For sanding:

Little 110.
Much 120.
For heavy sprinkling 125.
For elevated railroad 110.

For character of population:

Good 100.
Fair 200.
Bad 300.
For blocks with schools 100.
For blocks with produce markets 125.
For blocks with push-cart trade 175.
For blocks adjoining unpaved streets 200.

The accuracy of this table was checked by comparison with the number of sweepers actually employed in each subdivision in the city, and proper amounts of work were assigned to each in accordance with the observed conditions and the computed comparative difficulty resulting. Thus one sweeper can keep clean 20,000 square yards of asphalt in good condition. The number of sweepers necessary to keep a street clean under any combination of the above conditions could be obtained by multiplying 1 sweeper by the percentages of increase in the table for those conditions, adding the products to unity and multiplying the sum by the number of square yards in the street, divided by 20,000. For the entire city, 1,623 sweepers were employed, each sweeper keeping clean an average of 5,746 square yards, at an average cost of $2.40 per 1,000 square yards a week; indicating, according to the estimate above, that asphalt in good condition could be kept clean at 69 cents per 1,000 square yards a week. The cost for any of the given conditions can be approximated by multiplying 69 cents by the percentages of increase given for those conditions, and adding them all thereto, if rates of pay, rentals, etc., are assumed to be the same as in New York City. These figures do not include any of the cost of carting away the sweepings, nor any of the other expenses of the department, being simply the cost of cleaning the street. The resulting cost of cleaning corresponds fairly well with averages in other cities.

A very interesting report on snow removal and on the labor question in its relation thereto is also given.

Pay of Engineers.

Our own country is not the only one in which just complaint can be made of the estimation in which engineers' services are held. The East Elloe Rural District council, in England, is advertising for a surveyor to devote the whole of his time to the supervision and repair of 115 miles of road, furnish his own horse and a bond for 100 pounds, for 62 pounds 10 shillings a year—about $310. It is estimated that the keeping of the horse and the fee for the

bond will take half of this, leaving the surveyor less than $3 a week for his share. Many of our American engineers are justly complaining of the low prices of work of a similar grade, but few of them are reduced to such starvation wages as this. Doubtless it is an exceptional case, in England, but the Association of Municipal Engineers is laboring with a good will to improve the condition of practitioners in this line. Our own state engineers' societies will do well to follow its lead.

City Ownership of Water-Works at Kingston, Ont.

The city of Kingston, Ontario, purchased its water-works in 1888, and issued bonds for $120,000, apparently nearly the cost of the works. Since that time $192,600 additional bonds have been issued to pay for additional improvements, and $33,500 of bonds have been retired. There are now nearly three times as many miles of pipe, two and one-half times as many services, over three times as many water takers, and over five times as many hydrants, as in 1887, and the consumption is over twice as great, being 1,288,788 gallons a day in 1897. This amount of water is pumped in less time and with less expense for fuel than half the amount was pumped in 1887. Water rates were reduced 20 per cent. in 1888, 25 per cent. in 1890, and 15 per cent. in 1895, and still the works have paid the interest on the bonded debt, from $1,100 to $4,600 of bonds each year, the ordinary expenses of running, and have had a surplus of $3,500 to $7,000 each year. The hydrant rental is now practically the same ($1,620 a year), for 217 hydrants as it was in 1887 for 42 hydrants, the city being charged with this cost of service. The expenditures for new work have steadily decreased from $82,000 in 1888 to $3,300 in 1897. By the reductions in rates from $26.83 average per taker, in 1887, to $9.58 in 1897, by the steps above mentioned the revenues have been kept nearly constant, being only $5,400 (less than 25 per cent.), more in 1897 than in 1887. The careful supervision of expenditure has aided in making this possible. Total ordinary expenditures were increased only 50 per cent., though the amount of water pumped was doubled and the length of the system was increased from 10 miles to 27.75 miles. Most of this increase is due to the interest and sinking fund payments, the increase in actual working expenses being only $600 in ten years.

This appears, from the figures given in detail in the report, to be a remarkable instance of the possibilities of economy under municipal ownership. Public ownership has evidently popularized the use of water and efficient management has at the same time permitted large increase in the amount of water supplied, and still larger decrease in cost to consumer, while retaining the cost of running the works

at a nearly constant figure. This is evidence that municipal ownership, even of a small system, may be most economical for the public, when properly managed. The principle of requiring a certain amount to be paid by the city at large, here in the shape of hydrant rental, is adhered to. Until 1897 the amount required from the city was gradually increased, but not in proportion to the increase in number of hydrants, but in that year a material reduction in the charge to the city was made. In 1887 the city paid the company $37.50 a hydrant. In 1896 the charge to the city was $11.40 a hydrant, and in 1897 it was reduced to $7.45. These reductions are even greater than those to consumers, quoted above.

The comparative economy the last year of company management and the first year of city management is shown by the fact that the city ran the pumps eight hours a day longer, pumped 317,000 gallons a day more for $1,800 less cost for working expenses. The interest account was also reduced somewhat, indicating that the city could obtain money on more favorable terms than the company. The cost of fuel was also reduced, notwithstanding longer hours. The same economy in management extends throughout the period covered by the statements.

INFORMATION ABOUT MEN.

LOWRIE.—The Denver board of public works has appointed Mr. H. C. Lowrie city engineer, to succeed Mr. Donald W. Campbell. Much work is about to be done in extending the sewer system of Denver, and as Mr. Lowrie made the original plans for the system and had charge of the early work, his services were regarded as specially desirable in supervising the extensions. He has a reputation as an exceptionally capable engineer, and has a record as one of the best that ever served the city of Denver, where he lived for twenty-five years. The appointment, as shown by the comments of the Denver newspapers, is a very popular one. Mr. Lowrie was born in Lancaster, O., in 1851. He lived in Ft. Wayne, Ind., during his early manhood, but on account of ill-health went to Denver in 1873. He was first elected city engineer of Denver in 1875, and served till 1878. He was reappointed in 1879, and after an interval of a year, when he was chief engineer of the Denver & New Orleans railroad, was again re-elected as city engineer, holding the position until 1889. Now, after nine years, he is again in his old position, with much important work before him for immedite attention. He has done much engineering work besides the services performed for Denver. He made the sewer plans for Colorado Springs, Salt Lake City, El Pasco, Tex., and Jackson, Tenn., and was for a time employed as a consulting engineer on the sewerage work in New Orleans. He has also done much work for railroads in the West.

WARING.—The new administration in New York City, for reasons best known to itself, undertook to suppress the official report from the street cleaning department prepared by and under the direction of the commissioner, Col. Geo. E. Waring. The report was prepared with much care and was in type when the new administration came into power and refused to issue it. When these facts became known the Committee on Municipal Administration of the New York Reform club decided that no more practical work could be accomplished than to issue this report as a supplement to the June number of Municipal Affairs. This has been done, and thus a valuable city document has been preserved and put into permanent form.

The first chapter of this report, which by the way comprises nearly 250 octavo pages, is devoted to "Street Cleaning In Europe," being the result of a careful and thorough investigation made by Col. Waring in the summer of 1896. In the other chapters the work of the department is explained in detail. Every process is fully described, from the sweeping of the streets to the disposition of refuse off Sandy Hook or to the sale of bottles, rags, etc. A chapter on the "Adjustment of Labor Questions" is of particular interest in showing how disputes are promptly and satisfactorily settled by the department without strikes, boycotts or other labor troubles.

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GREENE.—Since the last issue of Municipal Engineering Col. F. V. Greene has been promoted, by appointment of the president, to a brigadier-general, and has sailed for the Philippine Islands in charge of the second expedition of troops. It has been confidently expected that his splendid executive abilities and his thorough military training would rapidly carry him to the front rank in the service. When the call for troops was issued Col. Greene quickly got his regiment, the Seventy-first New York, in readiness for service, having arranged to relinquish the management of the affairs of the Barber Asphalt Paving company, of which he is president, to Mr. A. L. Barber, and his regiment was the first to go to the front from New York. He was in camp with his regiment near Tampa when his promotion was announced, and immediately afterward he was ordered by the war department to report to Gen. Merritt at San Francisco for duty in the Philippines. The parting with his regiment was affecting, as his men were very fond of him. Gen. Greene belongs to a military family, his father and brothers having been officers in the army. He is a son of Gen. Geo. S. Greene, the oldest living graduate of West Point Military Academy, now a resident of Morristown, N. J. He was born in Providence, R. I., in 1850. He was a pupil in Trinity school in New York at the outbreak of the war, but obtained permission to accompany his father to the front, and was with him in the army of the Potomac for four years. In 1864 he was sent to Burlington college in New Jersey, and two years later, on the appointment of Gen. Grant, was admitted to West Point Academy. The next four years was passed in the practical work of surveying and marking the international boundary along the forty-ninth parallel. This gave the then Lieut. Greene much practical experience in difficult engineering, for which he has often proved himself fitted. Then followed a brief assignment to a confidential position under the secretary of war. His literary tastes were cultivated by much reading and many writings which he began to produce at that time. He was selected in 1877, with the approval of Gen. Sherman, and sent to Russia as military attache, where he arrived on July 18, to accompany the Russian army, with a view to report upon its operations during the Russo-Turkish war. He passed the remaining nine months of the war

BRIG.-GEN. F. V. GREENE.

with that army and was present at the battles of Shipka, Plevna, Taskossen, Sophia and Philippolis. When the Russian army arrived, Feb. 3, 1878, in front of Constantinople, Lieut. Greene, during the armistice, rode alone through the Turkish lines into Constantinople, a very hazardous undertaking, considering the prejudice, ignorance and fanaticism of the Turkish soldiers and citizens, who with great difficulty were persuaded that he was other than a Russian officer. Notwithstanding his comparative youth at that time, his military bearing, bravery, character and worth were recognized by the emperor of Russia and the king of Roumania, from whom he received decorations. His report to Gen.

Sherman, published under the title of "The Russian Army and Its Campaign in Turkey, 1877-78," was so well received that Lieut. Greene was at once recognized both as a clear, concise writer and as the best military critic in the United States at that time. The next phase of his life was that of municipal engineering, which began in 1879, when he was assigned to duty as assistant engineer commissioner of the District of Columbia, including, of course, Washington City. He was promoted to the rank of captain in 1883. He next became instructor of military engineering at West Point, where he served until 1886. He decided to leave the army and devote his time to civil pursuits. His experience in the work pertaining to roadways and pavements, and a careful study of them in the principal cities of Europe and America, led to a connection with the Barber Asphalt Paving company, of which he became vice-president, and a year or two later, when Mr. Barber wished to relinquish his duties as the chief executive of the company, Col. Greene became president. He has since continued in this position, and has rendered valuable service in the upbuilding of the vast business of the company. He has found time for much writing and is a frequent contributor to the leading magazines. As colonel of the Seventy-first New York regiment in the National Guard he kept in touch with military affairs, and through this connection is now brought to the front in the military field. The public may expect to hear much of him in the Philippines.

WALKER.—A great deal of brick paving and sewer construction is about to be undertaken at Independence, Kas., and Mr. Jno. M. Walker has been elected city engineer to take charge of the work. Mr. Walker has had twenty years of varied engineering experience in the West. He received his engineering education at the State University of Kansas. In 1879 he began active work, first as rodman, then as instrument man, on what is now the S. K. division of the Santa Fe railroad. He was subsequently placed in charge of the first division. From this road he was transferred to the Memphis system, then under the same management as the Southern Kansas, where he continued until that line was finished to Memphis. He was then appointed chief engineer of the Belleville & Centralia (now the Air Line), running from Belleville, Ill., to Mt. Vernon, Ill., wnich line he located and partly constructed, but work was suspended until the Air Line built the road. In 1885 he began water works construction as an engineer for Messrs. Comegys & Lewis, New York, constructing works at Belleville and Shelbyville, Ill.; Crawfordsville, Shelbyville and Warsaw, Ind.; Chillicothe, Mo.; Nebraska City, Neb; Lawrence, Kan., and constructed a reservoir for them at Bryn Mawr, Pa. Under the management of Coffin & Stanton he reconstructed works at Ft. Madison, Ia; Paoli, Kan.; Abeline and Topeka, Kan. He was superintendent of works at Lawrence for four years. He made plans for works at Chanute, Kan., and in 1895 made plans and built works at Coffeyville, Kan., where he acted as superintendent of water works and city engineer until this spring, when the election brought in a new set of officers. He planned and built 35,000 feet of sewers for Coffeyville and made plans for water works at Shawnee, O. T. He is now preparing specifications for brick paving and a complete sewer system for Independence, Kan.

BOEH.—The Cincinnati Board of City Affairs has appointed Mr. William H. Boeh superintendent of the reorganized water works department of that city. The position is one of importance, as the superintendent will have large responsibilities. Mr. Boeh is a native of Cincinnati. He was born there fifty-one years ago. He entered the office of Mr. Joseph Earnshaw, a well-known civil engineer, in 1863, and remained with him almost continuously until 1878. During the last few years of his connection with him Mr. Boeh became his partner, the name of the firm being Earnshaw & Boeh. In 1878 he was elected assistant engineer, in charge of sewers in Cincinnati. After occupying this position for about six months he was offered an apointment as assistant engineer on the New York, Chicago & St. Louis railway. Before its completion he became principal assistant engineer of the Michigan & Ohio railway, now the Cincinnati, Jackson & Mackinaw railway, being employed continuous until in 1884, he was again appointed assistant engineer, in charge of sewers, in Cincinnati, and toward the close of the year he was elected chief engineer of the city water works, which place he resigned in 1886 to take the place of assistant engineer in charge of repairing the city with granite and asphalt. In 1887 he was offered and accepted a position as assistant engineer of the Duluth, South Shore & Atlantic railway. He resigned this position to take the position of assistant engineer in charge of sewers and highways in Cincinnati. This he resigned in 1893 to engage in asphalt paving, becoming associated with the Trinidad Paving company, with which he continued until his election on June 1, 1898, to his present position.

CURRENT INFORMATION.

Municipalities Cannot Change Water Rates Fixed by Contract.

An important opinion was rendered by Judge Welborn in the United States district court, in the suit b.ought by the Los Angeles water company against the city of Los Angeles. The action was brought to have the city ordinance passed in 1897, fixing water rates for the year beginning July, 1897, declared invalid on the ground that it was in conflict with the terms of the contract entered into in 1867 by the city of Los Angeles on the one side and the assignors of the Los Angeles City Water company on the other side.

Under the contract of July 22, 1868, the city of Los Angeles leased its water works to John S. Griffin, P. Beandry and Solomon Lazarus, assignors of the Los Angeles City Water company, for a term of thirty years, to distribute water and receive the profits, and the city reserved the right to regulate water rates as follows:

"Always provided that the mayor and common council of said city shall have and do reserve the right to regulate the water rates, charged by said parties of the second part, or their assigns, provided that they shall not so reduce such water rates or so fix the price thereof to be less than those now charged by the parties of the second part for water."

On April 19, 1870, the common council accepted and the mayor approved a report of the commissioners, appointed by them, establishing water rates and charges for domestic purposes in accordance with those fixed in July, 1868. In June, 1871, the city council, on a report of a committee constituted similarly to the first one mentioned, established the same rates as those fixed in April, 1870. On August 13, 1874, a committee constituted in the same manner, reported that it had established water rates and charges fo" domestic purposes, taking as a guide as near as possible the charges and rates for domestic and other reasonable objects and purposes charged in July, 1868. This report was adopted, and a committee appointed in conjunction with the city attorney to draft an ordinance embodying the rates fixed in the report. On August 20, 1874, an ordinance so drawn was adopted by the council and the rates established by said ordinance were the same as those established in 1870 and 1871. Since, and including the year 1880, the city council has, in February of each year, passed an ordinance fixing the rates to be charged by all corporations and persons within said city supplying water to the inhabitants thereof, to be in force one year from and including July 1, which rates have been less than the rates charged in 1870, and the Los Angeles City Water company has collected the rates thus fixed by the city, and no more. In 1896 the council passed an ordinance fixing the rates to be charged for water for the year commencing July 1, 1896, and ending June 30, 1897, at less than they had ever been before. Suit was brought to set aside the ordinance, and in Februrary, 1897, the city passed the ordinance, making a still further reduction in the rates. The action of the Los Angeles City Water company in collecting the rates fixed by the several ordinances constitutes the only acquiescence (if it be acquiescence) in the action of the council. If the rates established in 1870 were collected for the year beginning July 1, 1897, and ending June 30, 1898, the revenues received by the Los Angeles City Water company from said rates would be more than $50,000 in excess of the amount which would be received under the rates named in the ordinance of Februrary, 1897. A statement was furinshed to the council in January, 1882, by the water company of its transactions for the preceding year, protesting at the same time against the establishment of any rates less than those which were in force at the date of the lease, July 22, 1868. In January, 1883, the company again furnished the council with a statement showing the names of the consumers of water, the rates paid during the year preceding the date of the statement, and also an itemized statement of the expenditures made for supplying water during the year preceding, but expressly denying any legal right on the part of the council to demand said statement or to fix any rates less than those which were in force in July, 1868, was filed. Similar statements, accompanied by similar protests, were made annually thereafter up to and including the year 1889, and since that time unverified statements or reports, showing its receipts and expenditures, have been made by the company to the council each year.

Judge Welborn's conclusions are that the contract of July 22, 1868, in so far as it provides that the city shall not reduce water rates below those charged at that date, is valid, and therefore that the ordinance of 1897, which was passed pursuant to constitutional and legislative requirements of the state of California does fix water rates below the minimum so prescribed, thereby impairing the obligations of said contract, and should be annulled.

Tariff on Asphalt.

A claim was made in a recent case by importers of asphalt mastic that under the act of 1897 it is dutiable at 20 per cent. ad valorem under sec. 6 and others, 50 cents per ton under paragraph 93, while duty was assessed at $3 per ton under paragraph 293. The board of general appraisers decides that the pertinent provisions of paragraph 93 are: "Limestone rock asphalt containing not more than 15 per centum of bitumen, 50 cents per ton; asphaltum and bitumen, not specially provided for in this act, crude, if not dried, or otherwise advanced in any manner, $1.50 per ton; if dried, or otherwise advanced in any manner, $3 per ton." We find as follows from the evidence: "1. That the merchandise is something more than rock asphalt, as it is rock asphalt combined with other bitumen or asphaltum. 2. That it is commercially known as asphalt, or more particularly as asphalt mastic. 3. That it is an asphalt not specially provided for. 4. That it has been advanced in value and condition by a process of manufacture. In view of these findings it would appear unnecessary to consider the report of the United States chemist that the merchandise contained more than 15 per cent. of bitumen. In accordance with our findings the assessment of duty at $3 per ton under paragraph 93 is affirmed."

Convention of Mayors and Councilmen.

The second convention of the League of American Municipalities will be held in Detroit during the first week of August. The local committee of arrangements in Detroit, of which Mayor Maybury is chairman and J. A. Robison is secretary, is endeavoring to bring a large number of visitors to the city in connection with the meeting, and it is expected that there will be many in attendance, especially from cities and towns within easy reach of Detroit, who do not belong to the League, a low rate of fare having been secured for the occasion. The Detroit committee is interested in making as great a success as possible of the meeting, and is proceeding independently of the business end of the organization in New York. The program for the meeting does not provide for special papers, but contemplates general discussion, on the subjects of garbage disposal, civil service boards, commissions or council committees, regulation of saloons, street paving, remuneration to cities for franchise rights, municipal ownership of public services, and public water supplies. Addresses of welcome will be delivered by Governor Pingree and Mayor Maybury, and there will be a response by the president, John MacVicar, mayor of Des Moines.

A Very Severe Test of Asphalt.

The Rockford, Ill., Register-Gazette reports that recently a Chicago, Milwaukee & St. Paul freight train crossed South Main-st. on the new asphalt pavement. The report says: "Instead of tearing up the top coating and gouging two ugly ditches across that thoroughfare the wheels of the cars left little more than a dim trace of their passage across the Trinidad. While the first news of the mishap caused consternation to the street department and the city offices in the Brown building, it is considered as the most conclusive test to which the new paving has yet been subjected. The train that made the plunge across the street was a string of gravel cars. The train was a long one, composed of nearly 50 cars, and was in the hands of the switching crew. Spectators expected to see the pavement a ruin. Only the faintest mark, however, was noticeable. The engineer reversed and pulled the cars back across the street and up onto the track without even so much as missing a wheel. Edward Main, the superintendent of streets, in speaking of the accident, said: "I could hardly find the place when I went down to look for it."

The Law on Street Paving in North Dakota.

The supreme court at Bismarck, N. D., handed down a decision reversing the decision of Judge Pollock in the paving case from Fargo, N. D., and holding that the law authorizing paving is constitutional and that all the expense of paving a city street shall be assessed against the abutting property in proportion to frontage.

Oyster Beds Destroyed by Sewage.

The supreme court has rendered a decision in the suit of Huffmire et al. vs. City of Brooklyn. The plaintiffs were two oystermen of Flatbush, N. Y., who received a permit in 1882 from the town of Jamaica allowing them to plant and grow oysters in a certain creek. In 1889 the authorities of the neighboring town of Flatbush were authorized by the state legislature to construct a sewerage system discharging into tide water. When the system was built its outfall was located about 300 feet from the plaintiffs' oyster beds. The sewage contained a gas-house refuse, sludge acid and other poisonous substances, which were deposited on the bed to such an extent as to

ruin the oysters planted in 1892 and remaining ungathered in 1893. Suit was brought against the city of Brooklyn, with which Flatbush was incorporated, in 1894. A decision in favor of the plaintiffs was rendered.

Furnace Slag as a Road Material.

A recent test in England of blast furnace slag as a road-making material places it somewhat below the best granite, but above limestone, flint and all other stone tested.

Agreed Prices on Cement Sidewelks.

The manufacturers and builders of artificial stone sidewalks in Grand Rapids, Mich., about twenty in number, have signed articles by which they agree to lay no cement walks under regulation prices, and by which those prices are fixed at 75 cents per square yard for American cement and 80 cents for German cement walks. The seven cement dealers in the city are responsible for having forced the sidewalk men to adopt this advanced schedule of prices, and they will sell no cement to a contractor who cuts these rates. The dealers say that the contractors have been laying walks for from 58 to 65 cents a square yard, which prices are bound to make the contractor lose; hence, the dealers are the ones who suffer at the end of the year when settlements are made.

An Illegal Attempt to Establish a Municipal Electric Lighting Plant.

The supreme court at Bismarck, N. D., rendered a decision in the municipal lighting case of Grand Forks, N. D. The suit arose over the letting of contracts for the equipment of a municipal electric light plant in which several citizens asked for an order prohibiting the payment of money under the contracts, the principal ground being that the execution of the contracts would illegally increase the debt of the city and that there was no legal appropriation made therefor. The petition was denied by Judge Fisk, but the supreme court reversed the decision. The building is completed and most of the machinery is in the city. It is thought, however, that the plant will be completed and run as a private enterprise for a time.

Rats as Sewer Cleaners.

A novel method for removing obstructions in a sewer was described by O. O. Thwing, of St. Louis, in a communication to the "Wrinkle Department" of the twenty first annual meeting of the Western Gas association, held at Detroit, Mich. Last summer an 8x10-in. box sewer, about 200 ft. long, leading from the gas works to the river, became stopped up and all efforts to open it by steam, sounding or flushing were fruitless. As the sewer is from 10 to 15 ft. under ground, the idea of digging down to it was not relished. This remedy had about been decided upon, however, as the only one, when the yard foreman, Tom Maguire, hit upon the plan of trying rats in the work. Accordingly traps were set that night and the next morning Maguire had three large rats, which he introduced into the mouth of the sewer, closing it with a wire screen. Other rats were put to work from day to day. There was no result for about four days, and then a small stream of slime and ooze appeared at the mouth of the sewer. The next day a fair stream of water was going through, and in two days it was cleared.

Legality of Assessments Per Front Foot for Pavements.

The supreme court of Wisconsin recently handed down a decision in the case of Hennessy vs. Douglas county, regarding front foot assessments. The city charter of Superior provides that "the opening, grading, paving or improvements of any street shall be chargeable to the lots or parcels of land benefited thereby in proportion to the benefits secured thereto." The board of public works is required, before any work is done, to view the premises and determine the damages and benefits accruing to each lot by the proposed change. A report on the work is placed on file for public inspection and a notice printed in the official paper that at a fixed date the board will hold a public hearing on the subject. All objections to the plan which are made at the hearing are reduced to writing, and the report—corrected or modified, if it is considered necessary—is sent to the city clerk. The city clerk notifies the city council at its next meeting of its receipt, and if that body takes no action on it, the report is considered confirmed. After the report is modified by the council or confirmed in the manner mentioned, a notice is published to that effect in the official paper, and any property-owner who may consider himself injured by the plan of assesment has a right to appeal within thirty days to the circuit court. In the case before the supreme court there was no question but the board of public works, the clerk and the city council had acted in accordance with the law. The lots on one street were assessed at the uniform rate of $425.48 per lot, with the exception of one block, which was

assessed at $1,355.03. It happened, however, that the assessment per lot divided by its frontage gave the same sum, $3.45 per foot, except in the case of the single block, which was $4.67. The plaintiffs claimed that the assessments were illegal, because based on the frontage system held invalid in a previous case. The case referred to for precedents was one in which the evidence of the engineer showed that the general method of making assessments was to take the whole number of feet frontage on the street, divide the cost by the number of feet and assess it at so much per foot. Although there was no report of the board asserting that the assessment was acording to the benefits accruing to each lot, the court held that under the laws of Wisconsin such an assesment did not comply with the statutes, although not necessarily erroneous. In the case of Hennessy vs. Douglas county, however, the court ruled that in the report of the board it was stated that the assessment was made according to the benefits secured to each lot or parcel; in determining what lots abutting on or adjacent to the street were benefited and the amount of such benefits in each instance, the board acted judicially, and after an actual view of the premises; consequently its judgment on the question could not be reviewed by the court, unless it acted upon an erroneous principle. The fact that the board, in its report, gave the frontage of the lots upon the street, or that it assessed upon each lot the exact cost of the improvement in front of it, did not itself vitiate the assessment. Nevertheless, a report that the board had assessed the expense of the improvement according to the front foot, without finding and stating that the special benefits were in that proportion, would not be in compliance with the law. The decision shows that the front foot assessment is legal under such charter provisions, provided it is distinctly stated the benefits to abutting property are in proportion to its frontage, whereas, failure to make such a statement will invalidate an otherwise proper assessment.

A Plan for Acquiring Municipal Ownership of Water Works.

A proposition for the purchase of the water plant by the Indianapolis Water company by the city of Indianapolis, Ind., has been suggested by William B. Hord of New York. Mr. Hord proposes the purchase of the water works by a cash payment of not to exceed $200,000, and the balance to be paid by installments out of the earnings of the water works and to be in no sense a liability or obligation of the city. This would involve an agreement on the part of the city to pay about $40,000 per annum additional rental for fire hydrants for a period not to exceed 25 years. The city nows pays $78,000 per annum, and under this plan it would be required to pay an annual hydrant rental of about $120,000. It is calculated that this would give the owners $3,000,000 for the plant. The purchase on the plan proposed will require the city to issue more bonds. These bonds may be sold, it is believed, on a 3½ per cent. basis. The annual payments of $120,000 could be made after this year, it is represented, because next the reappraisement of real estate will add approximately $15,000,000 to the city tax duplicate, which will increase the tax receipts nearly $90,000. Besides this the city still has a margin of 30 cents on the $100 in its tax levy, and an increase of 10 cents—increasing the levy for city purposes to 70 cents—would produce $75,000 additional, which, it is pointed out, would provide for the increasing expenses of the city and would carry the water plant. The board of public works has asked Mr. Hord for a specific proposal for the purchase of the water plant along the lines indicated in his letter to Mayor Taggart, and has asked for a fixed price and terms.

Contracts Must Be Advertised.

The Brooklyn League has made an attack upon Sewer Commissioner James Kane, Brooklyn, N. Y., taking for its basis the practice of giving out city contracts without advertising. The league charges that work has been performed by the sewer department at an exorbitant price. An order was granted by Justice Maddox, of the supreme court, directing Commissioner Kane to appear before him to be examined regarding the sewer contracts let out by him.

Decision Against a Water Board for Maintaining a Dam.

Judge Tarbox of the new eighteenth judicial district, St. Paul, Minn., has filed a decision in the case of Anton Newzell against the St. Paul water board. This is one of over fifty suits brought about one year ago by the farmers of Centerville asking for damages and an injunction against the St. Paul water board for building and maintaining a flume or dam at the outlet of Baldwin lake, in Centerville. They claimed that by means of the dam their lands had been overflowed for a series of years and damaged, and that the water board had never acquired the right to build or maintain the flume, and

asked for damages of $60,000. The Wenzell case, which was considered a test case, was tried in February, 1898, and the decision just filed grants a perpetual injunction against the maintenance of the dam and allows the plaintiff $1,900 damages for the injuries done to his lands prior to November, 1896, when the action was begun. This amount of damages is at the rate of about $10 an acre and on the same basis the total amount of damages in all the suits would be about $17,000.

The German Way of Thawing Out Frozen Water in Pipes.

A method of thawing out frozen water pipes consists, according to the Deutsche Hausbesitzer Zeitung, in shoveling away the snow from above the pipes, covering them one-quarter meter high with unslaked lime and pouring on water. In consequence of the heat generated thereby the ground and the pipes are thawed out.

Railroads Required to Maintain Bridges Over Their Tracks.

Judge Lewis, of the district court, St. Paul, Minn., issued two alternative writs of mandamus, June 15, to compel railroad companies to repair and maintain bridges over their tracks. The matter has been under consideration for some time and the application for the writs were made by the corporation attorney under a resolution of the city council. The railroads assert that they are not liable for the repairs to the bridges over their tracks.

Contracts Must Be Completed Within Specified Time.

In a decision handed down by the Kansas City court of appeals the special tax bills issued for macadamizing Fourteenth-st., from Virginia to Woodland, were declared void because the contractor did not complete the work of paving within the time specified in the contract. This is the second time that this court has decided that if a contractor did not finish his work in the specified time the special tax bills issued against abutting property to pay for it were void.

"The Disgraceful Condition of the Roadway" Caused a Death.

A teamster fell from a coal wagon at Third and Folsom-sts., in San Francisco, and received injuries from which he died. The coroner's jury rendered a verdict, finding "that death was accidental and caused by deceased being thrown from the seat of his wagon as the result of the wagon falling into a rut in the pavement; and this man's death was due to the disgraceful condition of the roadway at Third and Folsom-sts."

American Association for Testing Materials.

A meeting of the American section of the International Association for Testing Materials was held at the Engineers' Club of Philadelphia, Thursday evening, June 16, 1898. Mr. Gus C. Henning, as member of the International Council, called the meeting to order, and after briefly stating the object of the meeting, gave a resume of the work of the International Convention held at Stockholm, August 23, 24 and 25, 1897, and also of the council appointed by this convention. The American section was then formally organized with the election of the following officers.

President—Prof. Mansfield Merriman, Lehigh University, Bethlehem, Pa.

Vice-President—Prof. Henry M. Howe, Columbia college, New York.

Secretary—Richard L. Humphrey, in charge of the testing laboratory of Philadelphia.

Treasurer—Paul Krenzpointner, testing department, Pennsylvania railroad, Altoona, Pa.

Confidential Advisers—Prof. Henry M. Howe, Columbia college, New York; Dr. R. G. G. Moldenke, consulting engineer, Pittsburg.

The work of the International Association and of the American section, in particular, was discussed, and also the work of the various international committees. It was decided to hold the next meeting of the American section during the latter part of August, the time and place to be determined by the officers of the section. At this meeting the section will adopt a set of by-laws and will select members to represent the section on the various international committees to which have been assigned the work of studying the numerous problems submitted at the Stockholm meeting, and who will report at the next convention to be held at Paris in 1900.

Proposed New Paving Brick Specifications in Detroit.

The common council of Detroit, Mich., has under consideration the paving specifications recommended by the board of public works and amended by the committee on streets. The section of the specifications relating to paving brick seems to be of particular interest to the board. It is as follows:

"Shall consist of the best quality of sound, hard, burned paving brick, made and burned specially for street paving purposes, and shall stand all reasonable tests as to durability and fitness, to which paving material is usually subjected. All bricks to be round or bevel-edged and straight, free from

cracks and other defects and of uniform size, and of a quality to be approved by the board of public works and equal to the approved samples in its office."

The committee on streets recommends that all of the sections after the words "uniform size" be stricken out and the following words take its place: "as per samples in the office of the board of public works." Regarding the kind of brick bid upon the specifications read:

"Each bidder shall state in his bid the kind of brick that his proposition is based upon, which must be of such kind as has been approved by the board of public works, and the brick to be used upon the street under such contract shall be equal in every respect to the approved sample in the office of the board."

The committee's amendment recommends that after the words "of such kind" be struck out and the following substituted:

"As herein specified, and the brick to be used upon the street under such contract shall be equal in every respect to the samples in the office of the board of public works."

The object of the changes is said to be to take from the board of public works the power to decide what kind of brick may be used on the streets. The specifications, as drawn by the board, provide that the board shall have power to inspect and throw out unsuitable brick. While the committee does not strike that out, it practically nullifies it by inserting a clause requiring contractors to give a surety bond to keep brick and asphalt pavements in good repair for ten years and cedar block for five years. With such a guarantee, it is understood, the contractor could order the board's inspectors off the street, or, if he permitted them to inspect, the bond would be worthless. The committee has added to the cedar block specifications "vulcanized paving cement" as a filler.

New Publications.

The Technograph, No. 12, 1897-8, is the latest issue of the annual of the Engineering Societies of the University of Illinois. It contains a number of papers of interest to practicing engineers. One by Professor Talbot on "Standard Methods of Testing Brick" is considered in detail in another column. A new study of the effect of freezing mortar is given which corroborates former results that Portland cement mortars are not externally injured while natural cement mortars are to an appreciable extent. The strength of Portland cement mortars seems to be slightly reduced, but the natural cement mortars are materially increased in strength. There is an apparent misstatement to the effect that Portland cement mortars were never increased in strength by freezing, while the table gives several results in which frozen mortars have strength exceeding 100 per cent. of the standard. Another paper gives the results of tests of 6-inch cubes of concrete of various mixtures which will be of value to engineers in designing concrete structures for various purposes. Papers are also given on specification writing, corrosion of iron, repairs of masonry and by giving it a cement jacket, showing strength of rivet steel, a report of actual tests by Prof. Talbot and others. Published at University of Illinois, Champaign, Ill. 50 cents.

The annual publication of the Engineering Society of the University of Michigan, The Technic, contains many interesting and valuable contributions, among which are the following: "A Wyoming Irrigation System," by C. T. Johnson; "Law Hints for Engineers," Geo. W. Lilly; "Levelling Connections With the Detroit Water Works," C. W. Hubbell; "Strength of Wrought Iron Pipe at Low and High Temperatures," R. C. Carpenter; "The Ethical Status of the Engineering Profession," Charles Carroll Brown. Price 50 cents.

The twenty-fifth annual report of the Lowell (Mass.) Water Board for 1897, states that the water supply of Lowell is obtained from driven wells. The city had the usual experience of bad taste and odor from such water when stored in open reservoirs during the hot season, and decided to overcome the difficulty by storing it in a standpipe 40 ft. in diameter and 60 ft. high, the estimated cost of which is $13,300. Nearly 600 water meters have been introduced, as a result of which the consumption of water is nearly half a million gallons less than in 1896, although at the same rate of increase as occurred between 1894 and 1895 the consumption would be a million gallons per day larger. City Engineer Bowers recommends, in addition to the standpipe, that a new covered reservoir, with a capacity of one day's supply, be built.

Personal.

William Bryant has been elected street superintendent at Mattoon, Ill.

F. R. Smith has been appointed commissioner of highways at Bronxville, N. Y.

J. H. Tedders has been appointed superintendent of public works at Covington, Ky.

Wencel L. Cukierski has been appointed superintendent of parks at Grand Rapids, Mich.

W. A. Johnston has been appointed water commissioner for three years at Cincinnati.

David F. Snyder has been reappointed assistant engineer at Springfield, O., both at increased salaries in recognition of efficient service.

William A. Sweet has been elected commissioner of highways at North Providence, R. I.

H. O. Harney has been elected assistant engineer of Paducah, Ky., to have charge of the sewers.

Edwin A. Miller has been appointed chief engineer of the department of parks for the borough of Richmond, New York City.

George C. Diehl has been elected county engineer of Erie county, New York, to supervise the construction of improved roads.

John Graves, who has served for fifteen years as a park commissioner at Buffalo, N. Y., has been appointed superintendent of parks.

A. Hamlin has been elected superintendent of sewers at San Diego, Cal., to serve during the absence of Superintendent I. M. Shaw during the war.

Col. Henry T. Douglas, M. Am. Soc. C. E., formerly city commissioner of Baltimore, Md., has been appointed brigadier-general in the volunteer army.

Howard Buckley has been appointed clerk of the water board, Baltimore, Md., to succeed W. E. Thomson, recently appointed clerk in the tax office.

Street commissioners have been elected as follows: L. L. Lindsey, Lincoln, Neb.; A. G. Southey, Bridgeport, Conn.; Chris. Meismer, Connersville, Ind.

George Gless has been elected temporary city engineer at Allentown, Pa., during the absence of J. Howard Martz, city engineer, in the service of the government.

John Graham has been appointed chief engineer, Edward Bernier assistant engineer, and ex-City Engineer H. C. Thompson street commissioner at Sault Ste. Marie, Mich.

Earle B. Lovell has resigned his position as instructor in civil engineering at Cornell University to accept that of adjunct professor of civil engineering in Columbia university.

F. M. Price has been appointed temporary assistant engineer in the street and water department at Wilmington, Ill., during A. J. Taylor's absence in the government's service.

Charles Barker has been appointed water works inspector at South Bend, Ind. John Graham has resigned his positioin as superintendent of the board of water works trustees.

Superintendents of water works have been elected as follows: Hugh Doran, Port Huron, Mich.; Gladding W. Van Slyke, Mendota, Ill.; A. Bell, Athens, O.; Martin Noble, Fitzgerald, Ga.; Chas. S. Currier, Barre, Vt.; Melbourne S. Rogers, South Bend, Ind.; A. G. Scott, Cambridge, O.; B. H. Grove, Lebanon, Ind.; Richard Kuhn, Connersville, Ind.

Gen. Caleb H. Booth, Dubuque, Ia., died June 19, aged 82 years. Gen. Booth was Dubuque's first mayor, and for many years surveyor-general of the Northwest territory.

Albert Rabbe has been appointed city civil engineer at Bellevue, Ky., to serve during the absence of City Engineer Eugene Shinkle in the military service of the government.

M. A. Rafferty, assistant at the Long Island refinery of the Barber Asphalt Paving company, has been promoted to the captaincy of company F, Seventy-first U. S. volunteers, located at Tampa, Fla.

Edwin U. Curtis, ex-mayor of Boston, Mass., has been appointed a member of the Metropolitan park commission. Mr. Curtis was formerly a member of this commission, but resigned the position last year.

Col. William M. Black, corps of engineers, U. S. A. M. Am. Soc. C. E., and engineer commissioner of the District of Columbia, has been relieved of that position and assigned to the staff of Maj.-Gen. Wade.

Albert Steinfeld, Col. Eps Randolph, George Pusch, C. F. Schumacher, B. M. Jacobs and F. E. Russell have been elected members of the board of water commissioners at Tucson, Ariz. Mayor Bushman is president of the board.

Avery D. Andrews, general counsel of the Barber Asphalt Paving company, New York City, has been promoted to chief quartermaster of the Fifth army corps, U. S. volunteers, with rank of lieutenant-colonel, and is now located at Chickamauga.

Prof. Olin H. Landreth, of Union college, Schenectady, N. Y., has been engaged to examine and report on a system of sewage disposal for Saranac Run, Franklin county, N. Y. He has prepared plans for and recommended disposal by irrigation.

City engineers have been elected recently as follows: George C. Dunham, New Britain, Conn.; John L. Cooper, Ligonier, Ind.; Norris H. Brown, Newark, O.; W. A. Gage, Knoxville, Tenn.; James C. Shriver, Cumberland, Md.; Karl Hanson, Connersville, Ind.; John Seibert, Peoria, Ill.

Mr. G. R. Sturtevant was recently elected city engineer of Merrill, Wis., which has a population of 10,000, at a salary of forty cents per hour when actually employed. He did not qualify, but expresses a preference "to work at common laborer's wages of a dollar a day instead of disgracing the profession."

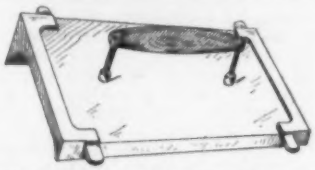
MACHINERY AND TRADE.

Dumping Wagons For Garbage and Other Uses.

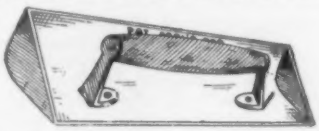
A little pamphlet issued by William Beckert, 340 Ohio-st., Allegheny, Pa., explains some of the advantages of the Eclipse dumping wagon for garbage and other hauling. It is claimed for this wagon that it can be dumped in five seconds. It combines strength and lightness, simplicity in construction, ease of running, and carries the load equally distributed on the front and hind gear. The wagons are made for either one or two horses and of any weight or capacity. The body is made of steel plate and will outwear two or three wood bodies. It has an automatic end gate device, and has a lever arrangement at the front end of the body by which the body when heavily loaded is easily and quickly rolled back to the dumping point. The wagons for garbage and sewer droppings have securely hinged and hasped lids, making them complete for the purpose.

Tools For Making Combined Curb and Gutter.

The Ideal Tool Co., of Indianapolis, Ind., which has been very successful in making useful tools for cement workers, has invented two new tools, which have been patented, for making the form of curb and gut-



ter known as the Parkhurst. Illustrations given herewith show the two tools. The first is for making the top of the curb, and the second is for the angle in the gutter. The two together enable a cement worker to make the best form of combined curb and



gutter. The tools are made in three different sizes, 4, 6 and 8 inches wide. The 6-in. tool is generally preferred. The tools save much time over the methods hitherto followed. Information and prices can be obtained by addressing the Ideal Tool Co., Indianapolis, Ind.

Intermittent Flush Tanks.

A pamphlet on intermittent flush tanks has been issued by the Pacific Flush Tank Co., of Chicago. It gives illustrations and descriptions of the various styles of the Miller & Rhoads-Williams automatic siphons with specifications for the construction of flush tanks, price-lists, a table of rates of discharge and testimonials showing the widespread use of the apparatus and the unusual satisfaction they have given. These testimonials are extracts taken from reports as to the working of the appliances manufactured and sold by the Pacific Flush Tank Co., and are published by permission, one only from each state being used. The pamphlet contains also an open letter to engineers worthy the consideration of all having in charge the designing or maintenance of a sewer system. Copies of the pamphlet can be obtained by addressing the Pacific Flush Tank Co., 84 LaSalle-st., Chicago.

Recent Inventions.

(Reported specially for MUNICIPAL ENGINEERING, by Arthur M. Hood, Indianapolis, Ind. Copies of any patent may be obtained for 10 cents.)

604,575—May 24, 1898—Garbage Wagon.—Peter Bauer, Cologne, Ehrenfeld, Germany. A wagon having receiving doors at the side, which doors open and close automatically.

605,029—May 31, 1898.—Dumping Cart.—J. W. Taylor, Hernden, Va. A dumping cart particularly adapted for landing garbage and similar substances.

605,153—June 7, 1898.—Suspension Bridge.—J. A. L. Waddell & I. G. Hedrick, Kansas City, Mo. The towers of this bridge are pivoted on their piers so as to swing or tilt length wise of the bridge. Both the upper and lower ends of the towers are then connected by cables, which are connected by suspenders which hold them in inverted curves as to each other.

605,385—June 7, 1898.—Street Sweeper—Alvin Brown, Aurora, Ill. In this machine there is a brush-carrying belt which delivers the dirt into a suitable receptacle.

605,415—June 7, 1898.—Street Sweeper—William Franz, Allegheny, Pa., assignor to Improved Street Sweeper company, Pittsburg, Pa. A sweeper having the usual rotary brush which throws the dirt into the path of a conveyor, which, in turn, carries it to a dirt receptacle carried by the main or rear axle.

605,474—June 14, 1898.—Bridge Construction—J. A. Davidson, Milsap, Tex. Each truss is composed of double series of parts, the parts being secured together between plates and the opposite trusses secured together by brace-rods which are adjustable in length.

605,488—June 14, 1898.—Cableway System and Apparatus for Excavating and Conveying—J. H. Lancaster, New York, N. Y. The dirt is excavated and partially elevated by means of grapples from which it is dropped into cars moving upon an upwardly and outwardly inclined track. The device, as a whole, may be moved along the line of excavation.

Trade Notes.

The Alcatraz Asphalt company will establish a plant in Louisville, Ky.

The Portland cement works at Salt Lake City, Utah, have been destroyed by fire.

The Utica Paving company, Utica, N. Y., will build an asphalt plant in Buffalo, N. Y.

The Ohio Vitrified Pipe Works, Lisbon, O., have, according to press reports, closed down for an indefinite time.

The Ayres Asphalt Paving company, of Zanesville, O., will erect an asphalt plant in Minneapolis, Minn.

The Chickasaw Asphalt company has changed the place of its pricipal office from Ft. Worth to Galveston, Tex.

The Alcatraz company, San Francisco, Cal., contemplates opening up the asphalt mines at La Patera, according to press reports.

The Austin Portland Cement company, Austin, Tex., has been incorporated by E. D. Stolley, A. T. Rose and S. Silverman; capital, $50,000.

The Western Paving and Supply company will erect a permanent asphalt plant in Evansville, Ind., where it has a contract for paving three streets with asphalt.

The McManus Contracting company has been incorporated to build sewers by M. McManus and L. P. Ridenauer of Philadelphia and John H. Ayres of Bordentown, N. J.

The Vulcan Clay company, Wellsville, O., has been reorganized by electing new directors, as follows: P. M. Smith, J. S. McNutt, W. E. Smith, W. Sniediker and Charles McKeehan.

The machinery and kilns of the Gem Paving company, Quincy, Ill., were considerably damaged recently by the large pond supplying the plant with water overflowing and rushing down on the plant.

The National Building and Supply company, Baltimore, Md., secured large contracts recently for furnishing Portland cement for the new fortifications at Bolivar Point; Ft. Point at Galveston, Tex.; North Point, near Baltimore; Ft. Philip, near New Orleans, La.

The Pridlam Sewage Utility company, Jersey City, N. J., has been incorporated for the treatment and disposition of sewage, by Samuel Pridham, Paul Buchanan and L. F. Mergott of Jersey City, and John Whitehead of Morristown.

A. B. Gould contemplates the manufacture of paving brick on his farm at the south end of Stone island, near Bay City, Mich. A vein of clay 20 feet thick, suited to that purpose, has been located 15 feet below the surface.

The Genral Contracting company has been organized in Indianapolis, Ind., to engage in the construction of sewers, streets, etc., in Indiana, Kentucky and Texas. John M. Lilly is president and Royal Robinson secretary of the company.

George Brandenburg of Chicago has assumed control of the Excelsior Clay company's large plant at Brazil, Ind., and will manufacture paving and hollow brick and other clay products. Extensive additions will be made to the place.

The Assyrian Asphalt company, of Chicago, recently brought suit in the United States court in Columbus, O., against the American Asphalt company, of Columbus, to recover $2,500 and interest since February, 1896, on a promissory note.

The O. S. Kelly company, of Springfield, O., presented the lowest bid for a steam road roller at Wausau, Wis., and the Gates Iron Works, of Chicago, was the lowest bidder for a stone crusher. The committee has recommended that the purchases be made of these companies, but no decision has yet been reached, owing to a proposition made by the Wisconsin Quartz company to furnish crushed rock or lease its plant at prices which the common council estimates would be less than to operate a crushing plant.

The Winona Bridge company, Winona, Minn., held its annual meeting June 16 and elected officers as follows: President, M. G. Norton; vice-president, J. A. Jordan; treasurer, H. W. Lamberton; secretary, H. W. Weiss of Chicago; assistant secretary, Thomas Simpson; superintendent, D. Cunningham of La Crosse.

Hetherington & Berner, Indianapolis, have recently shipped portable asphalt plants to the Warren-Scharf Asphalt Paving Company, New York, and F. E. Cole, Toledo. They are also now erecting a stationary plant for the R. F. Conway Co., Chicago, and have sold a stationary plant to the Assyrian Asphalt Co., of Chicago.

The circuit court at New Philadelphia, O., has affirmed the decision of the lower court in the suit of the Wrought Iron Bridge company of Canton, O., against W. B. Clough & Co., iron pipe founders, of Neomerstown, involving $16,000 for structural work. The decision disallowed claims for damages for alleged delay in supplying the work.

The Western Bermudez company, of Detroit, Mich., has been reorganized under the name of the American Contracting company, limited, for the purpose of enlarging the scope of its business. With the exception of E. G. Riesterer, who drops out of the company and is succeeded by William H. Love, of Buffalo, the officers and stockholders remain the same. Several kinds of contract work will be carried on by the firm other than that of laying asphalt pavements.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

Atlantic City, N. J.—The paving bill has been signed by Governor Voorhees and is now a law.

According to a recent report the streets of Manila are perfectly straight, macadamized and have granite walks.

Kansas City, Mo.—The city engineering department will hereafter insist that asphalt be used in paving street railway tracks on all streets paved with asphalt.

A bill has been introduced in the Ohio legislature which authorizes cities of second grade, fourth class, to pave streets with vitrified brick, one-half the cost to be paid by the city and one-half by abutting property-owners. The bill was introduced by Mr. Bartlow of Butler county.

Grand Rapids, Mich.—Kent-st., between Bridge and Hastings, has been recently paved with crushed stone with such satisfactory results that another block will be laid in the same manner. If, after a year's test, the street is still satisfactory, more streets will probably be paved.

Erie, Pa.—An ordinance transferring a sum of money from the Fourth ward street-paving fund to a fund for paving the intersection of Third and Sassafras-sts. has been signed by the mayor, and Sassafras-st. will now be paved with asphalt, from Fifth to Second. The contract was let to Mayer Bros. last summer.

Kansas City, Mo.—The move to secure open specifications in street paving was defeated in the board of public works by one vote. It required the unanimous action of the board. After July 1 all asphalt paving contracts must contain a ten-year maintenance clause. An effort was made to require a ten-year maintenance clause on brick paving contracts, also, but a protest from the brick contractors resulted in the matter being deferred for a time.

CONTEMPLATED WORK.

Montgomery, Ala.—Ordinances for brick paving have been passed.

Central Falls, R. I.—Central-st., from High to Hill, will be paved.

Chester, Pa.—Market-st. will be paved with brick. Coun. Robert E. Ross.

Shelbyville, Ill.—Paving is contemplated for the public square. W. H. Silver, cy. clk.

Worcester, Mass.—An ordinance has been adopted to pave Main-st. with asphaltina.

Charlotte, Mich.—The question of paving E. Lovett-st., with brick, is being agitated.

East Liverpool, O.—Brick paving in certain streets is favored by the council.

Waterbury, Conn.—The construction of asphalt or brick paving is contemplated.

Cedar Falls, Ia.—Vitrified brick paving is contemplated for several streets.

St. Joseph, Mo.—Paving is proposed for Seventh-st. Asphalt or brick is suggested.

Coldwater, Mich.—Brick paving is contemplated for one of the principal streets. cy. clk.

Hicksville, N. Y.—The board of supervisors contemplates the macadamizing of Broadway.

Newburg, N. Y.—Liberty-st., from Renwick to Broadway will be paved with granite or asphalt.

Logansport, Ind.—Press reports say that the question of asphalt paving is being agitated.

McKee's Rocks, Pa.—The question of bonding for $15,000 for street improvements will be voted on July 20.

Crafton, Pa.—The question of issuing $10,500 bonds for street improvements will be voted on July 26.

Newport, R. I.—Paving is contemplated for Thames-st. at an estimated cost of $25,000. Mayor Bogle.

Rockford, Ill.—The city council has, according to press reports, passed ordinances for paving five streets.

Leavenworth, Kas.—Paving is contemplated for Fifth-st. Brick, asphalt and macadam are suggested.

Winooski, Vt.—The village trustees voted, June 13, to construct concrete walks on Main and Allen-sts.

Wilmington, Del.—The street and sewer department has decided to pave a number of streets this summer.

West Hoboken, N. J.—An ordinance has been passed authorizing Trinidad lake asphalt paving for Clinton-ave.

Omaha, Neb.—A petition will be presented to council for improving Vinton-st., from Twentieth to Twenty-fourth.

Oberlin, O.—A resolution was passed, June 3, to grade, drain, pave and curb N. Main-st. Chas. Seth Brown, clk.

Oskaloosa, Ia.—The city council granted the petition of the residents in W. High-ave., June 13, for paving.

Minneapolis, Minn.—(Special.)—The gutters paved with asphalt about three years ago will be paved with brick.

Glens Falls, N. Y.—A resolution has been passed by the board of trustees for brick paving. W. J. Haskell, prest.

Sedalia, Mo.— Resolutions have been passed for paving, with brick, Ohio and Kentucky-aves. Jas. P. Quinn, cy. clk.

Troy, N. Y.—The board of county supervisors has petitioned the state engineer for about 18 miles of county roads.

Atlantic City, N. J.—The expenditure of $180,000 for paving the principal streets has been authorized.

Grand Rapids, Wis.—Bids will be asked soon, according to report, for asphalt paving; estimated cost, $22,422.

Hart, Mich.—The village council is reported as discussing the question of paving State-st., from Main to Lincoln.

Albany, N. Y.—Howard-st., from S. Pearl to Lodge, will be paved with vitrified brick and from Dodge to Eagle with granite.

Elgin, Ill.—Mayor Price contemplates paving Chicago-st., from Villa to Liberty, with brick, and, if it proves successful, will extend it.

Springfield, Mo.—A resolution was passed, June 15, to macadamize Campbell-st., from Walnut to College. G. W. Hackney, cy. clk.

Portage, Wis.—An ordinance was passed, June 20, to pave that portion of the streets now paved with cedar blocks with vitrified bricks.

Merchantville, N. J.—The property-holders have signed a petition requesting that every road in the town be paved with stone. Boro coun.

Cortland, N. Y.—Henry C. Allen, M. Am. Soc. C. E., Syracuse, N. Y., has been engaged as engineer in charge of the street paving in this city.

Philadelphia, Pa.—The construction of asphalt bicycle paths on the Walnut-st. bridge and its approaches is contemplated.

Pittsburg, Pa.—Final ordinances have been passed for paving and curbing Iowa, Ophelia, Cora and Cooper-sts. and Wright's alley.

Wallaceburg, Ont., Canada—The question of borrowing $5,000 for granolithic walks will be voted on July 6. H. E. Johnson, town clk.

Springfield, Ill.—Ordinances were passed June 10 for repaving portions of First, Allen, Washington, Edwards, Cook, Eighth and Ninth-sts. and Enos-ave.

Springfield, Mass.—The sum of $40,000 has been appropriated for paving and macadamizing. Plans have not yet been determined upon.

Marshfield, Wis.—The common council has voted to pave at least one block with crushed stone. The work will be done by contract.

Van Wert, O.—A resolution has been passed for paving Main-st. for a distance of one-half mile with brick, block or asphalt. Bids will be asked.

New Orleans, La.—An ordinance was introduced, June 17, requesting the comptroller to advertise for bids for paving Canal-st. with asphalt.

Pekin, Ill.—The construction of a stone and gravel road from the Illinois river bridge west to Orchard Mines is contemplated by the city council.

Fortville, Ind.—First-st. will be graded, graveled and concrete walks constructed. Concrete walks will be laid on S. Main and Stant-sts. also.

Chicago, Ill.—The board of local improvements ordered plans and estimates prepared, June 24, for opening Ogden-ave., from Union Park to Lincoln Park.

Meadville, Pa.—A petition has been favorably passed on to pave Terrace-st. with brick.

Watertown, Wis.—A resolution has been introduced favorable to the paving of Main-st., from the Main-st. bridge to Seventh-st., with brick. Mayor Mulberger.

Louisville, Ky.—The board of public works has under consideration the completion of Chestnut-st., from Thirtieth to Shawnee park, at an estimated cost of from $30,000 to $50,000.

Manchester, N. H.—The city engineer estimates the cost of paving Canal-st., from Granite to Auburn, 3,952 sq. yds.; with stone block at $2.35 a sq. yd., or $9,289.20.

Sioux City, Ia.—The question of paving Third and Water-sts. and the alleys in ten blocks with brick and Sixth-st. with asphalt is being discussed by the city council.

Duluth, Minn.—The board of public works is considering the advisability of repaving the old cedar block paved streets with brick, granite or macadam. President Smith, Bd. Pub. Wks.

Laconia, N. H.—The city engineer has been instructed to prepare plans and specifications and ask for bids for constructing the proposed boulevard from Lakeport to the Weirs.

Mattoon, Ill.—An ordinance has been passed to improve about 2,800 ft. of Nineteenth-st. by grading, curbing, paving and building catch basins and inlet basins. A. C. Loomis, cy. engr.

Fulton, N. Y.—(Special.)—O. C. Breed, cy. engr., has submitted plans and estimates for 17,000 sq. yds. of brick paving on First-st. A special election was called to vote on the question.

Schenectady, N. Y.—Ordinances have been presented to council for brick paving in portions of Park-place and Dock-st.; asphalt in Delmont-ave.; grading, curbing and flagging in Guysling-ave.

Chicago, Ill.—L. E. McGann, comr. bd. local improvements, has reached a final decision regarding the streets of this city, and as a result about thirty-five miles of streets will be paved with asphalt, brick or granite.

Lafayette, Ind.—The city council has decided to pave Sixth-st. with asphalt and construct cement sidewalks on a number of streets. It is probable that considerable asphalt paving will be done in the near future.

Bloomington, Ill.—The board of local improvements has recommended asphalt paving for Center-st., from Washington to Front. The property-owners on E. Washington-st., east of the Illinois railroad tracks, have petitioned for brick paving.

Atlanta, Ga.—The street committee of council has adopted the petition asking for asphalt paving on Washington-st. The property-holders on Whitehall-st. are again discussing the question of paving for that street. J. L. Maddux.

Peoria, Ill.—Recent press reports state that resolutions have been adopted for paving Perry-st., from Cornhill to the city limits, with asphalt, and Adams, from Spring to Cornhill, and Knoxville, from Main to Hamilton, with brick.

New Rochelle, N. Y.—The board of trustees passed a resolution June 13 to investigate the cost of paving streets through which the new trolley line will pass, from the tracks to the curb, with brick; also, the cost of macadamizing the streets which were recently graded.

Indianapolis, Ind.—Resolutions were adopted June 27 for paving with asphalt Eleventh-st., from Central to College, and from College to Bellefontaine; Delaware, from Twenty-fifth to a point 783 ft. north. Final action has been taken on brick paving for several alleys.

Milwaukee, Wis.—The board of public works passed favorably on a petition for paving Newberry boulevard, from Glen-ave. to Oakland-ave., with asphalt. This will be an extension of the pavement already laid in the boulevard from Lake-ave. to Glen-ave.

Kansas City, Mo.—The park board is considering a proposition, presented by Attorney Hunter N. Meriwether, for the improvement of the River Front boulevard, extending from River Front park in Kansas City, Kas., to North terrace, in this city, a distance of six miles.

Philadelphia, Pa.—The $11,200,000 loan bill for public improvements has passed both branches of the city council. About $2,500,000 will be devoted to street repairs and paving, $900,000 for abolishing grade crossing at the Philadelphia & Trenton R. R. tracks, $600,000 bridges, $500,000 for sewers.

Kansas City, Kas.—Resolutions have been passed for paving as follows: American bituminous rock asphalt, on concrete, Seventh-st., from Oakland-ave. to Parallel-ave.; Pittsburg brick on concrete, Darby-ave., from Lafayette-ave. to Ninth-st.; Oakland-ave., from Sixth to Seventh; curbing Central-ave., from State to Lime-st., with natural limestone curbing. Geo. E. Yeager, cy. clk.

Milwaukee, Wis.—The East Side aldermen and Samuel Brockman, comr. of pub. wks., decided June 11 to recommend that asphalt paving be constructed on the East Side as follows: Broadway, from Mason to Wisconsin; Oneida-st., from E. Water to the river; E. Water, from Biddle to Johnson; Juneau-ave., from Jefferson to Prospect-ave., and with brick, from Jackson to Van Buren; Hackett-ave., from Newbury boulevard to Milwaukee-Downer college. Improvements are being considered for the West Side as follows: Asphalt—Fifth-st., from Grand-ave. to Wells; Grand-ave., from Twenty-seventh to Western; Eleventh-st., from Vliet to Walnut. Brick—Grand-ave., from Fourth to Eighth; Chestnut-st., from Third to Seventh; Vliet-st., from Twelfth to Twentieth.

CONTRACTS TO BE LET.

Washington, D. C.—Bids are asked until July 23 for laying cement sidewalks. Dist. Comrs.

Mt. Vernon, N. Y.—Bids are asked until July 5 for grading Crary-ave. William N. Hoyt, cy. clk.

West Union, O.—Bids will be received untily July 8 for constructing turnpikes. J. M. Wittenmeyer, co. audt.

Madisonville, O.—Bids will be received until July 11 for building a macadam road. Bennett Carter, vil. clk.

Petoskey, Mich.—Sealed proposals will be received until July 5 for grading Liberty-st. Geo. W. McCabe, cy. clk.

Athens, O.—Sealed proposals will be received until July 9 for the improvement of Vine-st. W. B. Golden, vil. clk.

Salem, O.—Sealed proposals will be received until July 11 for brick and asphalt paving. F. W. Allison, cy. clk.

Ridgefield, N. J.—Bids are asked until July 12 for 3,000 lineal feet of macadam road on Edgewater-ave. C. B. Wilson, boro clk.

Wellsburg, W. Va.—Sealed proposals will be received until July 5, for paving sundry streets with brick. E. A. Sheets, chrmn. B. P. W.

Lima, O.—Sealed proposals will be re-

ceived until July 7 for 20,000 square yards of brick paving on W. North-st. C. E. Lynch, cy. clk.

Mansfield, O.—Sealed proposals will be received until July 9 for improving Adams-st., from Orange to Diamond. F. M. Remy, cy. clk.

Freehold, N. J.—Bids are asked until July 6 for constructing 7,870 feet of gravel road. John D. Honce, clk. bd. of freeholders.

Swanton, O.—Sealed proposals will be received until July 11 for 4,500 square yards of brick paving. F. H. Aldrich, corporation clk.

Columbus, O.—Sealed proposals will be received until July 12 for repairs and reconstructing seven roads. W. H. Halliday, co. audt.

Evansville, Ind.—Sealed proposals will be received until July 16 for paving three alleys with brick. Geo. W. Swearingen, clk. B. P. W.

Burlington, Ia.—Sealed proposals will be received until July 4 for paving, with brick, South, North and Arch-sts. Emmett Steece, cy. engr.

South Windsor, Conn.—Bids are asked until July 2 for grading and macadamizing the Ellington road. Harry S. Powers, 1st selectman.

St. Louis, Mo.—Bids are asked July 5 for grading and granite block paving on Cook-ave. and other streets. Robt. E. McMath, prest. B. P. I.

New Rockford, N. D.—Bids will be received until the July meeting of the county board for grading several roads. F. S. Dunham, co. audt.

Bridgeport, O.—Bids will be received in July for furnishing and constructing brick paving, curbing, etc. Hoge & Hix, engrs., Wheeling, W. Va.

New Ulm, Minn.—Sealed proposals will be received until July 5 for grading certain streets and constructing culverts. Louis Schilling, cy. clk.

West Shoals, Ind.—Sealed proposals will be received until July 6 for constructing gravel and macadam roads. Horatio Barryman, co. audt.

Davenport, Ia.—Sealed proposals will be received until July 2 for laying temporary and permanent sidewalks. E. W. Boynton, comr. pub. wks.

Cleveland, O.—Bids are asked until July 7 for paving with brick and curbing Duane-st., from Franklin to Wooodbine. Geo. R. Warden, dir. pub. wks.

Kansas City, Mo.—Sealed proposals will be received until July 7 for macadamizing two miles of the Hickman's Mills road. Thos. F. Callahan, co. surv.

Rockville, Ind.—Sealed proposals will be received until July 8 for grading, draining, graveling and bridging about 11 mis. of roads. E. H. Owen, co. audt.

Indpendence, Mo.—Sealed proposals will be received until July 1 for 7,500 square yards of asphalt paving on the public square. H. H. Pendleton, cy. engr.

Toledo, O.—Sealed proposals will be received until July 11 for macadamizing Bancroft-st. and for block paving in four streets. Lem. P. Harris, cy. clk.

Spokane, Wash.—Bids are asked until July 10 for 30,000 square yards of asphalt paving and 7,000 lineal feet of granite curbing on Riverside-ave. B. F. Fowle, secy. B. P. W.

South Bend, Ind.—Sealed proposals will be received until July 11 for paving the sidewalks in Pennsylvania-ave., Michigan and Pagan-sts. with cement. L. A. Hull, cy. clk.

Jamestown, N. D.—Sealed bids will be received until July 5, for furnishing road supplies needed by the county during the year. John F. Vernon, co. audt.

Wapakoneta, O.—Sealed proposals will be received until July 9 for grading, graveling, masonry and bridges on the Bowers and Moyer pikes. Samuel Craig, engr.

Mishawaka, Ind.—Sealed proposals will be received until July 11, for paving Bridge-st. with brick, with cement curbing and paving the sidewalks with cement. Geo. A. Tremel, town clk.

Ashland, O.—Bids will be received July 30, according to report, for constructing about 26,000 square yards of brick or asphalt paving on Cottage and Main-sts. F. L. Neiderheiser, cy. engr.

Des Moines, Ia.—Bids will be received until July 2 for 2,700 feet of curbing on Forest-ave., 4,600 square yards brick paving on Tenth-st. and 20,000 square yards of brick paving on Cottage Grove-ave. Bd. Pub. Wks.

Cincinnati, O.—Bids are wanted until July 22 for grading of grounds, roads and river bank, revetment of slopes and excavation of clear well, near California. Aug. Herrmann, prest. bd. trus., comrs. of w. w.

Canton, O.—Sealed bids will be received until July 2 for paving W. Tenth-st. fr. S. Market to S. McKinley-ave. with vitrified paving block on gravel foundation and constructing curbing. Louis N. Ley, cy. clk.

Pasadena, Cal.—Sealed bids will be received until July 5 for a franchise to erect and maintain over certain public streets and places an elevated cycleway road and path for the use of bicycles. Heman Dyer, cy. clk.

Des Moines, Ia.—Sealed proposals will be received until July 2 for paving Tenth-st. and Cottage Grove-ave. with brick on concrete and for curbing Eighth-st. with Portland cement curbing. G. A. Eberhart, C. E. Campbell, B. P. W.

Ft. Wayne, Ind.—Bids will be received until July 7 for paving with asphalt the following streets: High-st., from Wells-st. to St. Mary's-ave.; Cass-st., from Wells to 6th; Fairfield-ave., from Main to Jefferson. Cy. Engr. Randall.

Cincinnati, O.—Sealed bids will be received by Edwin C. Winter, clk. board of education, Warsaw special school dist. No. 1, until July 18 for grading and paving the basement in the school house in Delphi twp. Edwin C. Winter, care Early & Daniel n. w. cor. Sixth and Harriet-sts.

Ottumwa, Ia.—Sealed proposals will be received until July 5 for paving W. 2d-st., from Court to Clay, with asphalt on concrete foundation, with Portland cement curbing, and vitrified brick paving for a distance of 3½ on each side of the street car track. Bids will be received the same day for paving E. Court-st. and several alleys with brick on concrete. T. F. Keefe, chrmn. st. com.

Muscatine, Ia.—(Special.)—Sealed proposals will be received until July 5 for brick paving as follows: Imp. dist. No. 14—9,400 square yards brick paving, 2,831 lineal feet street curbing; 600 lineal feet concrete alley curbing, 7,000 cubic yards earth excavation.

Imp. dist. No. 15—7,065 square yards brick paving, 2,216 lineal feet combined concrete curb and gutter, 3,000 lineal feet 6x16-inch concrete curb, 4,000 cubic yards earth excavation. J. J. Ryan, cy. engr.

Washington, D. C.—Bids are asked until July 9 for paving certain streets with asphalt and asphalt block. Bids will be received at the same time for furnishing terra cotta sewer pipe, vitrified invert block, vitrified invert brick, sand, gravel, granite, curbing, asphalt paving blocks, vitrified paving blocks or bricks, sewer bricks and natural and Portland cements. John B. Wright, John W. Ross, Lansing W. Beach, Comrs. D. C.

Georgetown, O.—(Special.)—C. M. Gordon, co. engr., says bids will be received until July 6 for the Bald Point repair. This county contemplates building several miles of pike this summer. The county engineer has just finished the permanent survey of the Shinkles Ridge pike, 4 miles, and will have the specifications ready for advertisement in a few days. Any information desired will be furnished by the engineer.

CONTRACTS AWARDED.

Milton, Mass.—The contract for widening certain streets was awarded to W. H. Magne of West Newton for $71,000.

Lansing, Mich.—Woodcock & Kneal was awarded the contract June 21 for nearly a mile of brick paving for $29,000.

Houston, Tex.—The contract for repairing the Harrisburg gravel road was awarded June 7 to Hipp & Key at $1.50 per cu. yd.

Atlanta, Ga.—The Warren-Scharf Asphalt company was awarded the contract for paving Auburn-ave.

North Adams, Mass.—The contract for brick paving in four streets has been awarded to W. H. Lally & Co. for $15,120.

Chester, Pa.—Michael Hogan & Son secured the contract for paving Edgmont-ave. with brick at $1.48 a sq. yd.

Sandusky, O.—The contract for paving Wayne-st. with Newcastle asphalt block has been awarded to M. J. Callan for $32,045.

Allegheny, Pa.—The Park Fire Clay company, Pittsburg, was awarded the contract for 1,000,000 paving brick at $7.50 per 1,000.

LaSalle, Ill.—The contract for paving five streets with brick was awarded to Charley Bros. of this city for $64,204.

Hancock, Mass.—The contract for constructing a macadam road was awarded to Harris & Letterney of Boston for $2,973.

Athens, O.—Davis & Archer of Bellaire, O., have been awarded paving contracts, according to reports, for $6,380.07.

Cambridge, O.—The contract for paving Wheeler-ave. with brick was awarded to Adams Bros. of Zanesville for $22,434.22.

Bluffton, Ind.—The Warren-Scharf Asphalt paving company was awarded the contract for paving in Wabash-st. for $14,146.90.

Boston, Mass.—The Barber Asphalt Paving company has been awarded, without bidding, the contract for 1,200 sq. yds. of asphalt on Beacon-st.

Hartford, Conn.—The contract for macadamizing a portion of Durham turnpike was awarded to A. Brazos & Sons at 95 cts. per ft.

Quebec, Can.—The contract for furnishing 200 car loads of granite blocks for paving the streets was awarded to M. Fitzgerald of Sherbrooke.

Old Forge, N. Y.—The contract for constructing a road from this place to Eagle Bay was awarded to John H. Nelson and G. G. Harter for $14,871.

Rochester, N. Y.—The contract for asphalt paving on Yale and Linden-sts. was awarded June 20 to the Warren-Scharf Asphalt Paving company for $18,524.35.

Bay City, Mich.—The contract for paving Center-ave., from Madison to Johnson-st., with brick on concrete, was awarded June 13 to Hugh Campbell for $34,404.

Albany, N. Y.—Brick paving contracts have been awarded as follows: Green-st., 10,520 sq. yds., T. Henry Dumary, $2.10 a sq. yd. First-st., 7,400 sq yds., Mulderry Bros., $1.79.

Hagerstown, Md.—The contract for 6,500 sq. yds. of brick paving was awarded to E. G. Buck, of Bedford City, Va., at $1.28 a sq. yd. Clearfield brick will be used.

Jackson, Mich.—The board of public works recommended June 20 that the contract for brick paving be awarded to T. C. and H. M. Brooks, of Detroit, at $1.26 a sq. yd.

Minneapolis, Minn.—The contract for paving portions of Fourth and Third-sts. and Fourth and Third-aves., with asphalt has been awarded to the Ayres Asphalt Paving company at $2.15 a sq. yd.

Patchogue, (L. I.) N. Y.—The Eastern Brick Paving company, Catskill, N. Y., was awarded the contract for paving Main-st. with brick at $1.35 a sq. yd. for paving and 33 cts. per lin. ft. for curbing.

Florence, Ala.—T. F. Johnson secured the contract for grading and graveling Court, Mobile and Pine-sts. and Morrow-ave. at prices ranging from 14½ to 36¼ cts. per running foot.

Oskaloosa, Ia.—Brick paving contracts have been awarded as follows: N. C-st., Peter Nelson, $1.37 a sq. yd.; College-ave., O. P. Herrick, Des Moines, Ia., $1.36⅞; Fourth-ave., Geo. Carlon & Son, $1.36⅞.

Freeport, Pa.—The contract for paving Fifth-st. was awarded to Sweeney & Houston of Pittsburg at 92 cts. a sq. yd. for Mack brick, 40 cts. per lin. ft. for 15-in. pipe sewer and $15.60 each for sewer inlets.

Savannah, Ga.—The contract for repair and maintenance of asphalt paved streets for three years, with the privilege of five years has been awarded to the Southern Asphalt Paving company of Baltimore at $2.15 a sq. yd.

Meridian, Miss.—The contract for 10,000 sq. yds. of brick paving on Twenty-second-ave. has been awarded to C. H. Budd of St. Louis, Mo., at $1.80 a sq. yd. for paving, 25 cts. per cu. yd. for grading and 50 cts. per lin. ft. for granite curbing.

Des Moines, Ia.—Contracts were awarded, June 9, as follows: Curbing, 8th-st., Magden & Sheely, 30.9 cts. per lin. ft.; paving One-hundredth-st. with brick, Smith, Moss & Brown, $1.18 a sq. yd.; Cottage Grove-ave., J. H. Killmar, $1.41.

Davenport, Ia.—The Flick & Johnson Construction company of this city secured contracts for paving Fourth, Locust and LeClair-sts. at $1.29, Galesburg brick. Flick & Johnson secured contracts, June 14, for paving Thirteenth-st. and Grand-ave. with brick.

Louisville, Ky.—The contract for asphalt paving was awarded to the Southwestern Alcatraz Asphalt and Construction com-

pany of Baltimore at $18.72 per 100 sq. ft.; total, $30,000. The Barber Asphalt company bid $19.44 and the Warren-Scharf Paving company $22.23.

Lima, O.—The contract for 30,000 sq. yds. of paving was awarded, June 9, according to local reports, to O'Brien & Barr of Lima, as follows: Excavation, 28 cts.; concrete, 40 cts.; street curb, 49 and 66 cts.; cir. curb, 70 cts.; catchbasins, $18; extra haul, 3 cts.; Metropolitan blocks, 75 cts.

Fulton, N. Y.—(Special.)—O. C. Breed, cy. engr., says the contract for paving, on which bids were received May 27, has not yet been awarded. A committee was appointed to visit cities and inspect paving. The lowest bid was submitted by the New York Brick and Paving company of Syracuse at $1.97 a sq. yd.

Toledo, O.—The contract for paving Woodville-st. with with granite block was awarded, June 16, to Garrigan Bros., for $34,999.52; Second-st., Kerling Bros., $5,384.31; Kenilworth-ave., H. P. Streicher, $5,495.61½. The awarding of the contract for paving Batavia-st. was deferred for one week.

Ottawa, Canada—The contract for street paving was awarded to the Canadian Granite company, as follows: Alcatraz asphalt, tracked streets, $2.75; untracked streets, $2.65; guarantee fifteen years. The Warren-Scharf Asphalt Paving company bid $2.87 for tracked streets and $2.60 for untracked streets, with a fifteen-year guarantee.

Louisville, Ky.—The Barber Asphalt Paving company was awarded a contract, June 5, for street reconstruction for $22,000. Bids were received, June 21, for asphalt paving. The Barber Asphalt Paving company bid $16.83 and $15.69 per 100 ft. square respectively for first and second-class paving, and the Southwestern company bid $17. The contract has not been awarded.

Wilmington, Del.—Contracts for brick paving were awarded as follows: Athens Brick company, 1,139 sq. yds., 90 cts. a sq. yd.; George H. McCall company, Monsello blk., 3,480 sq. yds., 84 cts.; J. M. Solomon, Reading, shale, 7,185 sq. yds., 81 cts.; McMahon, Porter & Co., fire brick, 1,500 sq. yds., 85 cts.; Townsend Block and Contracting company, 3,150 sq yds., 97 cts.; Charles Warner company, 4,956 sq. yds., 97 cts.

Buffalo, N. Y.—The Barber Asphalt Paving company was the lowest bidder, June 3, for the following work: Surfacing or repaving Court-st., from Niagara-st. to the Upper Terrace—surfacing, Trin. asp., $4,618; paving Ashland-ave., between Lafayette and Delavan-aves., $4,347; resurfacing Ferry-st., between Main and Ellicott, $1,988.

Syracuse, N. Y.—Bids have been received for paving with asphalt or asphaltina as follows: The Asphaltina Construction company, $12,675.90; the Columbia Construction company of New York City, $13,727.80; the Empire Contracting company, $10,075, and the Warren-Scharf Asphalt Paving company, New York City, $13,682.38.

Hornellsville, N. Y.—The contract for brick paving was awarded, June 6, to James McCloud & Co. of Columbus, O., as follows: 2,100 cu. yds. excavation, 20 cts. a cu. yd.; 5,480 sq. yds. brick, on concrete, $1.30; 480 sq. yds. brick on sand foundation, $1.25; 1,830 lin. ft. curb, 35 cts.; 110 lin. ft. circular curb, 55 cts.; 200 ft. curb reset, 15 cts.; 1,800 lin. ft. 4-in. drain tile, 6 cts.; total, $8,983.

Troy, N. Y.—Paving contracts were awarded, June 14, as follows: Resurfacing Fifth-ave., between Broadway and Hoosick-sts. 11,000 sq. yds., Geo. McDonald, Trin. asphalt, $1.65 a sq. yd.; curbing, 66 cts.; Church-st., from Ferry to Division, Patrick Russell, Metropolitan fire clay block, $1.60; Middleburgh-st., from River to North, Mack brick $1.92; Tenth-st., from Hoosick to Middleburgh, Wm. Fitzsimmons, Catskill brick, $18,473.50.

Omaha, Neb.—The contract for widening Sixteenth-st., from Douglas to Izard 12-ft. and for raising and paving with asphalt the old cobblestone paved sewer gutters, was awarded, June 3, to J. B. Smith at $2.75 a sq. yd. John Cochrane secured the contract for grading Twenty-sixth-st. at 12 cts. a sq yd., and Hugh Murphy the contract for curbing Yates-st., from Fifteenth to Sixteenth, with Colorado sandstone, at 55 cts. per ft.

San Francisco, Cal.—Paving contracts have been awarded as follows: Chestnut-st., from Hyde to Leavenworth, Daniel O'Connor; Leavenworth, Lombard to Chestnut, Flynn & Treacy; curbing and paving Pierce, from Oak to Page, City Street Improvement company; Waller, from Pierce to Scott, San Francisco Paving company; sidewalks, Market, from Sanchez to Noe, Gray Bros.; macadamizing Third-ave., from Clement to California, P. McCaffagan.

Akron, O.—Bids have been received for sheet asphalt paving, with 5, 10 and 15 yrs. guarantee, as follows: Barber Asphalt Paving company, New York City, 6-in. concrete base, $11,445.84, $12,822.34 and $13,923.54; 4-in. concrete, $10,785.12, $12,161.62 and $13,262.82; Ayres Asphalt Paving company, Zanesville, O., 6-in. $10,965.98, $12,342.48 and $14,214.52; 4-in. concrete, $10,470.44, $11,957.06 and $14,324.64. Brick paving, France & Hassler, Akron, brick, $19,093.80; S. C. McGown, Akron brick, $20,201.45; Canton brick, $20,519.03; Herring & Son, $20,108.26; Akron or Canton brick; P. T. McCourt, Akron brick, $19,512.21; Canton brick, $19,988.58.

Albany, N. Y.,—T. Henry Dumary was awarded the contract, June 6, for paving Second-st., from Quail-st. to New York Central-ave., with brick, at the following prices: Nine thousand three hundred sq. yds. paving, 65 cts.; 5,390 ft. straight and 100 ft. circular granite curb, 25 cts.; relaying 100 sq. yds. pavement on sand, 45 cts.; 5 sq. yds. on concrete, 50 cts.; 50 lin. ft. curb on sand, 20 cts.; on concrete, 60 cts.; 51,600 sq. ft. new brick sidewalk, 8 cts.; 11,900 sq. ft. 4-ft. flag sidewalk, 14 cts.; relaying 9,800 ft. sidewalk, 3 cts.; 7 receiving basins, $80 each; 400 lin. ft. trench and 6-in. pipe, 30 cts.; 25 6-in. bends, 40 cts. each; labor on backfilling, $1.50; total, $23,624.

Philadelphia, Pa.—The Vulcanite Paving company was awarded contracts for paving a number of streets with sheet asphalt on broken stone, base and binder, at $1.20 to $1.28 per sq. yd. Richardson & Ross secured four streets at $1.24 and $1.34 a sq. yd. Contracts for paving a number of streets with Cape Ann granite blocks were awarded to D. J. McNichol at $2.34 a sq. yd, and for vitrified paving to Thomas Cunningham at $1.37 to $1.43, and George A. Neal at $1.35 to $1.49 a sq. yd. The prices are considerably lower than they have been heretofore, which fact is attributed by Director Thompson to the present policy of free competition for such improvements.

Zanesville, O.—Bids were received for paving recently as follows: T. T. Mulligan, Ironton, $25,120.96; Greenville Construction company, Greenville, $29,716.24; Adams Bros., Zanesville, $22,434.92; McCourt & Davidson, Akron, $30,755.99; M. McCarren & Co., Detroit, Mich., $23,369.08; Davis & Archer, Bellaire, $57,745.09; Henry Ganz, Columbus, $24,-305.17. The bids for furnishing brick were as follows: John C. Boler, Zanesville, 50c. per sq. yd; Charles J. Deckman, Malvern, O., 46½c. per sq. yd.; T. B. Townsend Brick company, Zanesville, 44c. per sq. yd.; Harris Brick company, Zanesville, 47c. per sq. yd.

Detroit, Mich.—Bids were received June 13 for asphalt paving in four streets. The lowest bid was submitted by the Barber Asphalt company, which bid $1.90 a sq. yd., exclusive of curbing, on Stimson-place, the eastern market and Randolph-st., from Monroe to Gratiot, and the contracts were awarded to the company. The American Construction company (formerly the Western Bermudez) bid $2.55 for paving Lawrence-ave., but the contract was held up on account of the bid being so high. Contracts for cedar block paving on concrete, with Medina curbstone, was awarded as follows: Seventh-st., $1.44, and Champlain-st., $1.48, Geo. E. Curry & Co.; Riopelle-st., $1.17, H. Merdian; Trumbull-ave., $1.13, Talbott Paving company; St. Aubin-ave., $1.26, John McLaughlin.

Allegheny, Pa.—Paving contracts were awarded June 7 as follows: A. V. Purnell, $7,218; grading, paving and curbing of Lithgow-ave., Ligonier block, brick sidewalks, Kreps Coal and Sand company, $4,552.50; grading, paving and curbing of Overlook-st., Ligonier block, vitrified brick sidewalks, Kreps Coal and Sand company, $4,390; grading, paving and curbing of Diana-st., sheet asphalt, brick sidewalks, Sicilian Asphalt Paving company, $3,658.50; grading, paving and curbing of Page-st., sheet asphalt, brick sidewalks, Sicilian Asphalt paving company, $4,860.

Jamestown, N. Y.—Bids were received June 18 for about 40,817 sq. yds. of brick paving, as follows: Gust. Berland, gravel concrete foundation, $70,664.38; broken stone foundation, $80,484.43. Jamestown Construction company—Gravel concrete, $70,094.21; broken stone, $83,015.46. Alcatraz Paving company, Philadelphia—Gravel concrete, $75,-169.10; broken stone, $82,882.50. James R. Van Camp, Olean, N. Y.—Gravel concrete, $75,129.79; broken stone, $80,812.44. Henry Garity and Chas. Varnum—Gravel concrete, $69,180.47.—Horace W. Walker—Gravel concrete, $68,117.49; broken stone, $81,038.68. German Rock Asphalt company, Buffalo—Gravel concrete, $70,185.63; broken stone, $73,286.73. A. N. Broadhead and G. E. Maltby—Gravel concrete, $68,289.18; broken stone, $81,233.58.

Kansas City, Mo.—Paving contracts were awarded as follows: Thirty-first-st., from Grand-ave. to Holmes, Barber Asphalt Paving company, $2.12 or $21,690.60; Twenty-fourth-st., from Southwest boulevard to Fairmount-ave., Parker-Washington company, $1.655 or $12,154.50; alley between Main and Walnut-sts., Trestrail Paving company, $1.56 or $658.32. J. R. Dennison & Co. was awarded several asphalt paving contracts, May 28, amounting to about $18,000, and the Barber Asphalt Paving company was awarded contracts for paving Mercer and Seventh-sts. and Bates-ave. at $2.12. J. R. Dennison & Co. is a new asphalt paving company in this city. The Barber Asphalt Paving company secured several contracts June 22 at $2.10 and $2.12 a sq. yd. Other contracts awarded June 22 were: Reconstructing and paving Eleventh-st. with brick, Parker Washington company, $1.85 a sq. yd.; Askew-ave., brick, R. J. Boyd Paving and Construction company, $1.50; Twenty-third-st., brick, M. Mense, $1.54½; Twenty-eighth-st., brick, Trestrail Paving company, $1.53½. Bids were received for asphalt paving on Sixteenth, Brooklyn, Seventeenth and Euclid-sts., but the awarding of the contracts was postponed until July 8. The Barber Asphalt company bid $2.12 on those streets and J. R. Dennison & Co. $2.08 and $2.09, but as this company has not yet filed bonds for contracts awarded it May 28 the board of public works decided that it would become satisfied of the company's ability to carry out the former contracts before awarding it more.

SEWERS.

Clinton, Ia.—Plans have been prepared for a sewerage system in Ash-st., which will require about three mis. of brick and pipe. C. P. Chase, cy. engr.

New Martinsville, W. Va.—A sewerage system will be constructed. L. J. Miller, C. E., of Martin's Ferry, O., has made surveys preparatory to the work.

San Rafael, Cal.—The question of issuing $26,000 bonds for building 8,000 ft. of pipe sewers will be voted on July 16. Geo. L. Richardson, cy. engr.

Bath-on-the-Hudson, N. Y.—The village trustee has ordered sewers constructed in First and Broadway-sts., from Central-ave. to Washington-st.

Worcester, Mass.—The question of appropriating $70,000 for continuing the construction of the separation system on the west side is being considered.

Herkimer, N. Y.—The construction of a separate system for storm water drainage has been recommended by F. K. Baxter, Utica, N. Y. E. W. Sluyter, clk. mun. comn.

Toledo, O.—Ordinances have been approved for the construction of a brick sewer in Eastern-ave., and for pipe sewers in other streets and alleys. Lem P. Harris, cy. clk.

Columbus, O.—A resolution was adopted June 13 to construct the several lines of sewers in sub-sewer district I of main sewer district No. 1. John T. Barr, cy. clerk.

Philadelphia, Pa.—The council's survey committee decided June 7 to favorably recommend an appropriation of $50,000 for constructing branch sewers in various parts of the city.

Salem, Mass.—The board of aldermen referred to the sewerage committee June 5 an order to appropriate $250,000, to be raised on a loan, to establish a chemical plant to treat sewage.

Racine, Wis.—Plans and estimates have been adopted for a sewer in St. Patrick-st., and plans and specifications will be made for sewers in Prospect and Howland-aves. Cy. Clk. Schroff.

Lake Bluff, Ill.—A special assessment law has defeated the proposition to construct a sewerage system, but other plans are being contemplated. T. R. Butman, B. J. Cloes and Thos. Pearson, com.

San Diego, Cal.—Surveys, plans and estimates for the Eighth ward sewer have been

completed. About 15.48 mls. of 6 to 30-in. pipe sewers will be required; estimated cost, $108,229. Edwin M. Capp, cy. engr.

Andover, Mass.—The proposed sewerage system will include 6 mls. of 15 to 6-in. pipe sewers, 1 mi. 12-in. cast iron pipe, an inverted syphon, six acres of filtration beds, settling, etc.; estimated cost, $80,000. Wm. L. Jenkins, chrmn. com.

Newark, N. J.—Ernest Adam, city surveyor, submitted four plans to the board of works June 21 for a sewerage system for the West Side. The estimated cost of the plans are: No. 1, $103,676; No. 2, $141,167; No. 3, $218,236; No. 4, $325,653. Further consideration was postponed one week.

Altoona, Pa.—(Special.)—Harvey Linton, cy. engr., says estimates have been made for a needed storm sewer system, to cost $43,000, to be built in sections, as required. First section, 7 and 8 ft. sewers; to cost for 1,311 ft., about $1,400. This work will hardly be commenced this year, as no appropriations for it have been made.

Buffalo, N. Y.—The estimated cost of abating the Hamburg canal nuisance is $705,873. The plan is to fill up the canal, and the sewage, of which it is the present outlet, will be carried off by a system of 13 new sewers, which will empty into a pumping station, where the refuse will be pumped into the Swan-st. trunk sewers. Cy. Engr. Bardol.

Johnstown, N. Y.—Olin H. Landreth, C. E., of Union college, Schenectady, N. Y., has been engaged to report on a comprehensive plan of sewerage and sewage disposal for the entire city. Owing to the large amount of tannery waste and chemicals which the system will have to take care of ultimately, the plan is somewhat complicated. Since 1882 the city has been sewering into Cayadutta creek, which runs through the city. An injunction, which was granted a mill-owner and which was recently affirmed by the court of appeals, has been temporarily suspended by agreement with the complainant, but the city is anxious to provide a permanent system by which it may comply with the injunction and stop the expense of the payments to the mill-owner.

CONTEMPLATED WORK.

Fowler, Ind.—The question of sewage disposal is being considered.

Grand Rapids, Mich.—A sewer has been recommended for Sheldon-ave.

Kingston, Pa.—Plans have been prepared for constructing sewers.

Oil City, Pa.—The construction of a sewer at a cost of $10,000 is contemplated.

Waseca, Minn.—Plans and specifications have been made for a sewerage system.

Stockton, Pa.—A system of sewers will be constructed at once. Town Solicitor Miller.

Taylorville, Ill.—The construction of a sewer, at a cost of $15,000, has been authorized.

Deadwood, S. D.—The establishment of a sewerage system on Stewart-st. is contemplated.

Newport News, Va.—Bids will soon be asked for constructing the proposed sewerage system.

Goshen, Ind.—The construction of one mile of 30-in. pipe sewer is contemplated. Cy. Engr. Cooper.

McKees Rocks, Pa.—An ordinance providing for $10,000 for sewer extensions will be voted on July 20.

Pittsfield, Mass.—The board of public works voted June 13 to extend the sewer system on Tyler-st.

Fergus Falls, Minn.—Separate bids will be taken for a sewer on Whitford and Cleveland-aves. Cy. clk.

Seymour, Ind.—The construction of a pipe sewer, 2,800 ft. long, is contemplated at a cost of $2,473.

Paterson, N. J.—The construction of sewers in sundry streets has been ordered. Thos. McLean, cy. st. comr.

Williamsport, Pa.—Sewers are proposed for W. Fourth-st., First and Erie-aves. and Oliver-st. Mayor Mansel.

Newton, Kas.—The construction of sewers, at a cost of about $7,000, is contemplated. Dr. S. D. Bennett, chrm. com.

East Hartford, Conn.—Surveys have been made for sewers in the Meadow district. Jos. Goodwin, town clk.

Des Moines, Ia.—A sewer is proposed for the southeast portion of the city. Geo. M. King, cy. engr.

Wallingford, Conn.—The question of constructing a trunk sewer has been favorably voted on by this borough.

Bellevue, Pa.—This place has voted to issue $48,000 bonds for sewer construction. Wm. Martin, chrmn. com.

Hamilton, O.—Plans for a storm sewer in Market-st., from Water to Fourth, have been filed. M. O. Burns, cy. clk.

South Bethlehem, Pa.—The question of issuing $100,000 in bonds for a sewerage system will be voted on July 26.

Columbus, Ga.—The question of issuing $150,000 bonds for sewer and bridge construction will be voted on Aug. 19.

Crafton, Pa.—The question of issuing $30,000 bonds for sewers and street improvements will be voted on July 26.

Schenectady, N. Y.—The construction of sewers in E. Liberty-st., is proposed. Chrmn. Holtzman of rds. and bridge com.

Bushnell, Ill.—The question of constructing a sewerage system is being considered by the council. Ald. Wierather.

Lancaster, Pa.—This city has appropriated $20,000 for sewer extensions and improvements. Edwin S. Smeltz, cy. clk.

Sioux City, Ia.—The construction of 20-in. tile and 24-inch. pipe storm sewers has been recommended by St. Com'r Siman.

Brewer, Me.—The question of issuing $10,000 bonds for a sewerage system has been favorably decided upon. Mayor Sargent.

South Bethlehem, Pa.—The question of issuing $100,000 sewerage bonds will be voted on July 26. R. E. Neumeyer, boro engr.

Cleveland, O.—Resolutions have been adopted to construct sewers in a large number of streets. Howard P. Burgess, cy. clk.

Holyoke, Mass.—The question of constructing a sewer to drain the new Highlands is being agitated; estimated cost, $75,000.

Marshall, Mich.—H. E. Riggs, C. E., Toledo, O., has been engaged to prepare plans for the sewerage system. Ald. Joy and Anson.

Alexandria, Ind.—The construction of 10 and 12-in. pipe sewers in a number of streets is contemplated. J. W. Tomlinson, cy. clk.

Waycross, Ga.—This city will vote, July 9, on the question of issuing $50,000 bonds for a sewerage system. R. P. Bird, clk. coun.

Wausau, Wis.—A resolution has been passed for the construction of a sewer on Forest-st., from Fourth to Seventh. Chas. F. Beck, cy. clk.

Mattoon, Ill.—An ordinance has been passed by council for building catch basins and inlet basins in Nineteenth-st. A. C. Loomis, cy. engr.

Fall River, Mass.—The treasurer has been authorized to raise $100,000 for the extension of sewer outlets. Phil D. Borden, cy. engr.

CONTRACTS TO BE LET.

Elkins, W. Va.—Bids will be received until July 6 for constructing a sewer. W. W. Mills, recorder.

Le Sueur, Minn.—Bids will be received until July 8 for constructing a sewer. Theo. G. Mahler, cy. clk.

Roanoke, Va.—Bids will be received until July 16 for constructing sewers. J. H. Wingate, cy. engr.

Los Angeles, Cal.—Bids will probably be received July 5 for constructing three alley sewers. Cy. trustees.

Owosso, Mich.—Bids will be received, July 6, for the construction of a sewerage system in West Owosso.

Shelby, O.—Bids are asked until Aug. 1 for constructing sewers. J. B. Weddell, engr. in charge, Mansfield, O.

Gilmore City, Ia.—Bids will be received until July 5 for laying 470 ft. of 8-in. tile on Main-st. Town coun.

Aurora, Ind.—Bids are asked until July 2 for constructing a sewer in Second-st. and sewers in several alleys. J. J. Backman, cy. clk.

Rat Portage, Ont.—Bids will be received until July 6 for making sewer connections. D. L. Mather, chrmn. B. P. W.

Plattsburg, N. Y.—Bids are asked until July 5 for constructing sewers in several streets. Lee Rockwell, vil. clk.

Washington, D. C.—Bids are asked until July 9 for furnishing sewer pipe, brick, cement, etc. John W. Ross, dist. com.

Jefferson City, Mo.—Bids will be received until July 5 for constructing a sewer in dist. No. 4. Cy. Engr. Harding.

Chicago, Ill.—Sealed proposals will be received until July 5 for constructing sewers. L. E. McGann, prest. bd. local imp.

LaCrosse, Wis.—Bids will be received until July 2 for constructing a 12 and 15-in. pipe sewer on Fourth-st., between Cass and Market.

Mt. Vernon, N. Y.—Bids are asked until July 5 for constructing pipe sewers in sundry streets. Wm. N. Hoyt, cy. clk.

Wellsburg, W. Va.—Sealed proposals will be received until July 5 for laying a sewer in Liberty-st. E. A. Sheets, chrmn. B. P. W.

Avalon, Pa.—Bids are asked until July 5 for constructing 24-8-in. pipe sewers in a number of streets. J. A. Toy, chrmn. com.

Lancaster, N. Y.—Bids are asked until July 7 for making plans for a sewerage system and sewage disposal plant. Geo. Bingham, chrmn. bd. comrs.

Elyria, O.—Sealed proposals will be received until July 5 for the construction of West and West River-sts. sewer. W. H. Park, cy. clk.

Evansville, Ind.—Sealed proposals will be received until July 16 for constructing a sewer on Elsas-ave. Geo. W. Swearingen, clk. B. P. W.

New Ulm, Minn.—Sealed proposals will be received until July 5 for constructing five blocks of 18 and 24-in. pipe sewers. Louis Schilling, cy. clk.

Chicago, Ill.—Sealed proposals will be received until July 5 for constructing a sewer in Fair-ave., from Seventieth to Sixty-eighth-st. L. E. McGann, comr. pub. wks.

Savannah, Ga.—Sealed proposals will be received until July 5 for constructing one mile of brick sewer and 49 miles of pipe sewers with appurtenances. Clk. council.

Lamberton, Minn.—Sealed proposals will be received until July 7 for laying 552 ft. of 10-inch sewer and for taking up and relaying 203 ft. of sewer. J. H. Gebhard, vil. rec.

Huntington, Ind.—Sealed proposals will be received until July 12 for constructing a 15 and 10-inch pipe sewer on Etna-ave., from Jefferson to Fredericka-st., with manholes, catch basins and appurtenances. Frank Guthrie, cy. C. E.

Muscatine, Ia.—Bids will be received until July 5 for 618 ft. of 24x38 two-ring brick sewer; 1,012 ft. of 28x42-inch two-ring brick sewer; 300 ft. lin. ft. of 10-inch pipe storm water connections; 140 ft. 6-inch sewer branches; 10 receiving basins; one stone mason outlet. Bids were received for this work June 16, but upon the consideration of the proposals none of them were found to be made in conformity to the instructions, or in legal manner, and the council ordered all bids rejected. J. J. Ryan, cy. engr.

CONTRACTS AWARDED.

Cambridge, O.—Adams Bros., of Zanesville, O., secured the contract for building sewers for $9,413.05.

Meridian, Miss.—The contract for constructing sewers was awarded to Burkhalter & Co., of Birmingham., Ala., for $5,200.

Little Falls, N. Y.—The contract for constructing a sewer in Loomis-st. was awarded to Hallinan Bros. for $14,430.

Meadville, Pa.—James McAffee & Co., Allegheny, was awarded the contract for a storm sewer on N. Main-st. for $1,659.30.

Lexington, Ky.—The contract for constructing the sewer at the asylum was awarded June 15 to Thomas Smith & Son for $2,650.

St. Louis, Mo.—The contract for repairing and reconstructing sewers was awarded June 17 to John L. Kelly for $13,890.

Milwaukee, Wis.—Geo. E. Zimmerman secured the contract for laying sewers in Concordia, Providence and Cambridge-aves. and Bartlett-st.

Chicago, Ill.—Sewer contracts have been awarded to Ed Connor, Joy & Co., Jas. Healy, Simon Ryan, Andrew Maloney and Thos. J. Burke.

Winooski, Vt.—The lowest bid presented for constructing a sewage system was that of M. J. Fitzpatrick, of Plattsburg, N. Y., $13,212.

Crookston, Minn.—The contract for the sewer on Main-st. was awarded to Andrew Olsen at 80 cts. per lin. ft. and $40 each for manholes.

Kenosha, Wis.—The contracts for sewers on Maple, Pearl, Elizabeth and Exchange-sts. were awarded to the N. F. Reichert company, of Racine, for $4,873.

Marshalltown, Ia.—The contract for constructing 2,145 ft. of sewer was awarded to J. C. Dunn, of this city, at 47 cts. a lin. ft. and $23.75 for manholes.

Springfield, Mass.—Daniel W. Mellen se-

cured contracts for building sewers for $8,-724.80. Maloney & Peterson was awarded the contract for the Douglas-st. sewer extension for $4,808.3.

Watertown, Wis.—The contract for building sewers during the year were awarded to Wm. Gorder at 42 cts. per lin. ft. for 8-in. pipe sewers; $25 for manholes; $27 for flushtanks.

New Haven, Conn.—The contract for constructing a sewer in Hallock-ave. was awarded to A. Brazos & Sons for $10,682, and J. W. Whitby secured contracts for sewers in four streets for about $5,400.

Butte City, Mont.—The contract for building the Jackson-st. sewer was awarded to E. O. Dugan & Co. for $3,424; Arizona and Front-sts., Karlman & Jennings, $2,190; catchbasins, H. S. Joyner & Co., $1,745.

Altoona, Pa.—(Special.)—Harvey Linton, cy. engr., says contracts for terra cotta pipe sewers, 8 and 10-in., were signed June 19 as follows: 1,279 ft., $705.92, Isaac Bender; 2,466 ft., $1,958.94, Charles B. Clark.

Erie, Pa.—Edward Driscoll was awarded the contract for a 15-in. sewer at $1.65 for 15-in. straight and curved pipes, 40 cts. for 9-in. and 30 cts. for 6-in. pipe. $1.90 for 15-in. Y or T branches and $45 for manholes.

Dayton, O.—Chas. Hoskot was awarded contracts June 22 as follows: Van Cleave-st., $3,550.85; Railroad-st., $3,103.30. John Munger & Co. secured the contract June 14 for building the Seeley ditch sewer extension fr $2,600.

Marion, Ind.—Contracts for a sewerage system were awarded June 7 as follows: Central district storm sewer, Kalamazoo Construction & Supply company, $3,396; sanitary sewer, McCourt &Davidson, $16,008; S. Main storm sewer, Greenville Construction company, $19,720.

WATER-WORKS.

Greensburg, Pa.—Judge McConnell decided June 9, that the injunction granted against council to restrain it from issuing $17,000 bonds for establishing a water works system should remain in force until further orders of the court.

New York City.—The T. A. Gillespie company, who have the contract for laying seven miles of 36-in. water main in the west roadway of the Boulevard, hope to have it completed by July 1. Its estimated cost was $275,000.

Kansas City, Mo.—The water committee of the upper house has agreed that a reduction of water rates 25 per cent. to those not having meters, instead of a 15 per cent. reduction to all water consumers, would be a better plan, and a substitute ordinance is being prepared.

Oshkosh, Wis.—W. G. Maxcy, manager of the Oshkosh Water Works company, has a plan under way to secure a pure supply of water from Green Lake for this city. The estimated cost of getting the water here is $200,000, but it is thought that even with the additional expense the plant can be made to pay well.

Des Moines, Ia.—The city council, the citizens' water committee, representatives of the Des Moines Water company and the water company bondholders have decided upon the final terms by which the water plant will become municipal property. The transfer will be made July 1, 1900, for $850,-000 of 4 per cent. city bonds.

Springfield, Ill.—As an experiment toward avoiding the electrolysis of water pipes by electric currents Major J. W. Southwick, superintendent of water works, has been empowered by the water works committee of the council to make electrical connections with the water pipes running in the vicinity of the power house of the Cosmopolitan Railway company.

Council Bluffs, Ia.—Application was made, June 10, for the appointment of a receiver for the property and franchise of the Council Bluffs City Water Works company. The application was made by the Farmers' Loan and Trust company of New York, who also asked for an injunction restraining the company from selling, assigning or incumbering the property.

Los Angeles, Cal.—The Los Angeles City Water company offered, June 14, to sell its entire plant to the city for $2,000,000, and the same, with the addition of the property of the Crystal Springs Water company, for $3,000,000. The water supply committee reported recommending that the city council offer to buy all the property, including the Crystal Springs plant, for $1,300,000. It is known that the company will refuse to accept this offer, which is $1,700,000 less than the price at which the company agreed to sell. Under the contract arbitration must follow the refusal, and if the company refuses to arbitrate the matter will go to the courts. City Engineer Dockweiler has completed maps showing the area covered by the Big Tejunga proposition, the drainage basin, reservior sites, etc. The water shed covers an area of 134 square miles. There are eight reservior sites.

CONTEMPLATED WORK.

Grand Ledge, Mich.—A storage reservoir will be constructed.

Flagstaff, Ariz.—Plans are being prepared for a gravity water works system.

Minneapolis, Minn.—The purchase of a new pump for the water works is contemplated.

Columbus, Ga.—The installation of two power (water) pumps, and about 30,000 ft. of 8-6-in. mains is proposed.

Baldwin, Ia.—Plans for a water works system have been made by the Iowa Engineering company of Iowa City, Ia.

Kingfisher, Okla.—Plans are being prepared for water works, including wells, pumping plant, etc.

Liveoak, Fla.—Thos. Dowling desires to purchase a 35 h. p. return tubular boiler for the water works.

Opelika, Ala.—The water supply is inadequate and the question of obtaining a larger one is an important one.

St. Joseph, Mo.—(Special.)—G. R. Rackliffe, cy. engr., says plans are being prepared for a water works system.

Hawley, Minn.—This town is agitating the question of putting in a tank and mains for a water works system.

Two Harbors, Minn.—Bids will probably be asked soon for a steam pump and an electric light plant. John Dwan, supt. w. w.

Columbus, O.—The council is reported as having authorized $175,000 in bonds for a storage dam in the Scioto river.

Norwalk, O.—The contract will be let soon

for the construction of a standpipe and the completion of the water works system.

Unadilla, Ga.—This city has voted to issue $4,000 8 per cent. bonds for the proposed improvements to the water works.

Marietta, O.—Bonds will soon be sold for the completion of the water works and the construction of an electric light plant.

Warren, Pa.—The question of issuing $50,000 bonds for the proposed municipal water works will be voted on July 12. John Masterson, prest. boro.

Newburg, N. Y.—The construction of a supplemental 20-inch water main in Washington-st. is being considered by the water commissioners. Prest. Sneed.

Crestline, O.—The question of securing a water supply for the Branch Hospital in Lick Run is again being considered by the city hospital trustees.

Fulton, N. Y.—(Special.)—O. C. Breed, cy engr., says a special election was called for June 28 to vote on raising $115,000 to build a new water works system.

Amery, Wis.—The question of erecting a pumping station and installing a water system for North Twin lake to connect with th present system will be voted on July 1.

Rockingham, N.C.—W. N. Everett, mayor, desires to correspond with manufacturers of pumping machinery and with contractors.

Florence, Colo.—(Special.)—P. T. McGuire says: "We are figuring on a water works system for our town and I would like to correspond with some good reliable consulting engineers."

Newburgh, N. Y.—John D. Van Buren and Everett Garrisons, engineers, submitted their report for a new water supply to the water commissioner, June 13. They estimate the cost at $235,000.

The question of constructing water works is being agitated at the following places: Dayton, Tenn.; Armada, Mich., Danbury, Ia.; Hammond, Minn.; Madison, Ga.; Butler, Ky.

Jersey City, N. J.—The Jersey City Street and Water Board rejecfed all the pending bids for a permanent water suply, June 23, and will advertise for new bids without delay.

Tucson, Ariz.—A board of water and sewerage commissioners will be appointed to investigate the cost of machinery, location, etc., for the water works and sewerage systems. Chas. T. Connell, cy. clk.

Baltimore, Md.—A resolution was introduced, June 17, authorizing the health committee of the city council to investigate the proposed purification of the city water supply. The council adjourned until Sept. 26.

Montgomery, Ala.—The committee is urged by Mayor Clisby to ask for bids for furnishing 50,640 ft. of 4, 6 and 8-in. cast iron water pipe, 120 gate boxes, 60 hydrants, etc., for the water system. J. T. May, chrmn. com.

Philadelphia, Pa.—The largest single item in the $11,200,000 loan bill for public improvements is $2,700,000, which, it is understood, will be used to start filtration, and $1,000,000 for a reservoir for West Philadelphia.

Great Falls, Mont.—The council has rejected the offer made by the Great Falls Water Works, to sell its plant for $400,000. The investigating committee has recommended the issue of $260,000 for an independent water system.

St. Paul, Minn.—The board of water commissioners contemplates, according to report, acquiring land and deepening the Centerville and Peltier lakes of the Rice Lake extension of the water works system, at an estimated cost of $100,000.

Moline, Ill.—A resolution was adopted, June 20, requesting the board of local improvements to adopt some system of filtering the city's water supply, and authorizing the board to employ an engineer to make plans, specifications, etc., required for such improvement.

The question of issuing bonds for water works construction will be voted on as follows: Ruston, La.; Fred W. Price, mayor, Paw-Paw, Mich.; T. J. Cavanaugh, Augusta, Wis., July 6; Gilmore City, Ia.; Phoenix, Ariz., July 18; Breckenridge, Col., July 25; Augusta, Wis., July 6.

The question of constructing water works has been favorably voted on at the following places: Van Alystine, Tex.; Cass City, Mich.; Coun. C. W. Keller—Keota, Ia.; Blair, Wis.; College Hill, O.; Olin, Ia.; Oxford Junction, O.; Maynard, Minn.

The construction of water works systems is contemplated at the following places: Slocan City, Minn.; Ada, Minn.; Oxford, Mass.; Alden, Ia.; Sebastopol, Cal.; Enderlin, N. D.; Attica, N. Y.; Cloverport, Ky.; F. N. D'Huy, cy. clk.—Central Lake, Mich.; Elmore, Minn.; Nekoosa, Mich.; Osage, Ia.; Greeley, Col.; Cedarvale, Kas.

Clinton, Ia.—(Special.)—A resolution has been passed instructing the city engineer to examine the plant of the Clinton Water Works company and report to the city council what changes are, in his opinion, necessary to give the city first-class fire protection. Charles P. Chase, city engineer, says the city council insists on extensive improvements in the distribution system, and if these are not commenced at once will take steps to terminate the contract, and either grant a franchise to a new company or else build a city plant. As a compromise the water company has proposed to lay several miles of larger mains.

CONTRACTS TO BE LET.

Wynne, Ark.—Bids are asked until July 15 for building water works. Geo. W. Eldridge.

Ogden, Ia.—Bids are asked until July 5 for constructing a water works system. J. H. Noyes, mayor.

Cambridge Springs, Pa.—Bids are asked until July 8 for constructing water works. Geo. L. Wade, clk.

Summit, Miss.—Bids will be received until July 5 for constructing a system of water works. J. B. Holden, mayor.

Boone, Ia.—Sealed proposals will be received until July 6 for two boilers for the water works plant. Jesse L. Hill, cy. clk.

Lamberton, Minn.—Sealed proposals will be received until July 7 for laying 565 ft. of 6-in. water main. J. H. Gebhard, vil. sec.

Morris, Minn.—Sealed bids will be received until July 9 for constructing a water works system. Anton Watzke, prest. com. coun.

Sycamore, O.—Sealed proposals will be received until July 26 for constructing a water and light plant. E. J. Eystine, vil. clk.

Austin, Tex.—Bids are invited for one outside packed plunger pump of 4,000,000 gals. capacity and motor for same. H. C. Patterson, supt. w. w.

Lincoln, Neb.—Bids will be received until July 23 for constructing a complete water

works system for the Feeble-Minded Institute at Beatrice, Neb. Com'r public lands & bldgs.

Montgomery, Ala.—Bids are asked until July 16 for constructing about 10 miles of cast iron water mains, including gates, hydrants, etc. R. H. Somerville, cy. treas.

Winnipeg, Man.—Bids will be received until Aug. 8 for furnishing cast iron pipe, specials, hydrants, valves, etc., for the proposed water works system. C. J. Brown, cy. clk.

Huntington, Mass.—Sealed proposals will be received until July 9 for furnishing about 481 tons of cast iron water pipe, specials, hydrant valves, etc. Leonard F. Hardy, chrm. water comrs.

Ridgewood, N. J.—Bids will be received until July 27 for furnishing a supply of pure and wholesome water. Bids must be based upon specifications furnished by bidders. H. G. Ward, vil. clk.

Evansville, Ind.—Sealed proposals will be received July 12 (extended from July 1), for constructing engine and boiler houses and a chimney for the water works. Fred Grote, mem. bd. w. w. trus.

Guthrie, Okla. T.—Sealed bids will be received until July 5 for furnishing not less than 500,000 gals. of pure water per day. Bidders to furnish their own plans and specifications. Robert Henderson.

Winnipeg, Man.—Sealed proposals will be received until July 25 for the construction and supply of a system of wells and pumping plant for the supply of 4,000,000 gallons of water daily to the reservoirs of the city. C. J. Brown, cy. clk.

Coolgardie, West Australia.—Bids are asked until Aug. 23 for furnishing 246 miles of 31-in. riveted steel pipe, and 82 miles of from 26 to 28-in. welded steel pipe, for the proposed water works system of this city. Seward, Guthrie & Steele, 40 Wall-st., New York City, American office. C. Y. O'Connor, Engr.-in-chief, Perth, Western Australia.

CONTRACTS AWARDED.

Kendrick, Wash.—H. Orchard of Portland was given the franchise for a system of water works in this city.

Mingo, O.—The contract for constructing the water works has been awarded to John Patton of Pittsburg.

Edwardsville, Ill.—The contract for building water works was awarded to Tuxhorn Bros. of this place.

Bedford, Pa.—The contract for building a reservoir has been awarded to H. P. Malone, Hollidaysburg, Pa., for $12,146.

Juneau, Wis.—The contract for extending the water works system was awarded to D. Ahearn & Son of Fond du Lac for $2,468.

Chicago Junction, O.—The Ohio Pipe Co., Columbus, O., was awarded the contract for cast iron pipe June 9 at $14.70.

New Sharon, Ia.—The contract for constructing a water works system has been awarded to Jackson & Moss of Des Moines for $7,860.

Sharpsville, Pa.—The contract for constructing water works was awarded, June 9, to the Standard Boiler & Bridge Co. of Bellaire, O., for $23,422.

Memphis, Tenn.—A meeting was called June 13 for the purpose of hearing and ratifying the agreement which had been reached with the water company relative to the extension of the mains in South Memphis, over the territory in which new sewers have been recently laid.

Ellis Island, N. Y.—The contract between Jersey City and the U. S. Government for supplying this place with water at $100 per 1,000,000 gals. has been signed by Mayor Hoos.

Flagstaff, Ariz.—The contract for constructing water works has been awarded to the American Asphalt company of Los Angeles, Cal., for $65,000. The pipe will be of asphaltum.

Rome, N. Y.—Bids were received June 10 for an auxiliary steam pumping station at Ridge Mills, as follows: George F. Woolston, New York City, $17,793; Henry R. Worthington, New York City, $14,850; Holly Manufacturing company, Lockport, N. Y., $18,800.

Perth Amboy, N. J.—Bids were received June 20 for a 4,000,000-gal. pump, as follows: Buffalo Steam Pump company, North Tonawanda, N. Y., $16,200; Snow Steam Pump works, Buffalo, N. Y., $13,840; Blake Pump company, $22,500; Laidlaw-Dunn-Gordon company, 401-403 W. Fifty-ninth-st., New York City, $13,000; Barr Pumping Engine company, Gtn. Junction, Philadelphia, Pa., $12,000.

Media, Pa.—The contracts for improving the water works were awarded June 7 as follows: Pumping engine and foundation, tubular boiler, filter and foundation, settling basin, steel stack, heater with piping and accessories, Robt. Wetherill & Co., Chester, Pa., $11,388; pumping station, including stack foundation and pumping well. Isaac N. Flounders, Media, $6,440; wrought iron standpipe, complete, including foundations, Walsh Boiler works, Springfield, Mass., $2,895.

BRIDGES.

Oshkosh, Wis.—The council contemplates building a bridge across Sawyer creek.

Wichita, Kas.—The county committee contemplates building several iron bridges.

Fargo, N. D.—Bids will be received until July 8 for constructing three bridges. Co. audt.

Flint, Mich.—The construction of a new bridge across Flint river has been petitioned for.

Rushford, Minn.—The construction of an iron bridge is contemplated. W. F. Drake, cy. clk.

Hyde Park, N. Y.—The construction of a bridge over Crum Elbow creek is contemplated.

Chillicothe, O.—Bids are asked until July 19 for building a 500-ft. bridge. Co. comrs.

Jefferson, Ia.—The county board has voted to build an iron bridge over Buttrick's creek.

Elkton, Md.—Bids are asked until July 5 for constructing four iron bridges. Co. comrs.

Shreveport, La.—Bids are asked until July 5 for building several bridges. P. Youree, prest.

Providence, R. I.—Estimates have been ordered prepared for a bridge over Woonasquatucket river.

Wauseon, O.—Bids are asked until July 5 for constructing an iron bridge over Ten-Mile creek.

Rahway, N. J.—Plans will be prepared for a new bridge at Bridge-st. Lewis Quien, co. engr.

Ivesdale, Ill.—An ordinance has been passed to build an iron bridge over East Lake Fork ditch.

Buffalo, N. Y.—A bill has been passed for building a bridge across the Niagara river at Grand Island.

Galena, Ill.—The proposed construction of a bridge at Turtle's mill has been favorably voted on.

Rolfe, Ia.—The construction of two new bridges, 40 ft. long, across Lizard creek is contemplated.

Columbus, Ga.—The question of issuing $150,000 bonds for bridge and sewers will be voted on Aug 19.

Richmond, Va.—Estimates for the construction of four bridges have been presented by the city engineer.

Burlington, Ia.—Petitions have been filed for the construction of six bridges. Chris. Mathes, chrmn. bd. co. supervisors.

Sprague, Wash.—Bids are asked until July 7 for building a bridge over Crab creek. J. W. Gunning, co. clk.

Moscow, Idaho.—Bids are invited until July 12 for constructing the Taylor bridge. Jay Woodworth, co. clk.

Carthage, Miss.—Bids are asked until July 4 for a bridge over Lobutcha creek. J. L. McMillon, clk. bd.

Victoria, B. C.—Plans are being prepared for a bridge 939 ft. long, of the Howe truss pattern. B. P. W.

Roseburg, Ore.—Bids are asked until July 8 for building a bridge over Elk Creek. A. F. Stearns, co. judge.

Louisville, Ky.—The construction of an iron bridge has been recommended by the Jefferson county board.

Decatur, Ill.—The Wrought Iron Bridge company, Canton, O., was awarded the contract for constructing a bridge.

Blue Earth City, Minn.—A petition has been presented to the county board for a new bridge across Rice creek in Delavan.

Maryville, Mo.—Bids will be received until July 6 for the construction of 29 bridges. Jas. K. Young, brige comr.

South Bend, Ind.—The county commissioners have been petitioned to build a new iron or stone bridge at Jefferson-st.

Springfield, Ill.—The construction of three bridges at a total cost of $3,700 is contemplated. John H. Pipe, co. clk.

Norwalk, O.—Bids are asked until July 16 for constructing a bridge on the Gates road, Greenfield twp. A. Sheldon, co. aud.

Rockville, Ind.—Bids will be received until July 8 for repairing the abutments to the Bridgeton bridge. E. H. Owen, co. audt.

New York City.—A new steel bridge over Newton creek, at Blissville, has been authorized by the board of estimate and apportionment.

Rushville, Ind.—Bids will be received until July 6 for constructing three bridges north of Falmouth, Ind. E. L. Kennedy.

Aberdeen, S. D.—Bids will be received July 8 for constructing a steel bridge across James river, near Rondell. J. H. Miller, co. audt.

Des Moines, Ia.—Bids will be received, July 3 for building a bridge across the Des Moines river, between Madison and Jefferson twps. Co. comrs.

Sycamore, Ill.—An appropriation of $2,000 has been voted for building an iron bridge to take the place of the "Roman" bridge.

Chillicothe, O.—Bids will be received until July 19 for building an 80-ft. bridge over Deer creek on the Westfall road. Co. Audt. Adams.

Gettysburg, Pa.—Bids are asked until July 13 for building a high truss iron bridge over Conowago creek, in Butler twp. Henry Hantz, co. comr.

Mondovi, Wis.—The bridge across Fisher's pond, which has been condemned, will be replaced with either a stone or iron bridge.

Mason City, Ia.—Press reports state that bids received for one 75-ft. and one 100-ft. steel bridge, have been rejected.

Richmond, Ind.—Bids will be received, July 2, for building a new stone bridge 4 miles west of Richmond. S. L. Bay, co. bridge com.

Tacoma, Wash.—Plans and specifications for the Elbe bridge are completed and bids will be asked soon. W. D. C. Spike, co. audt.

Carlisle, Pa.—The Wrought Iron Bridge company, Canton, O., has been awarded the contract for building a bridge at Bishop's fordway for $3,400.

Changewater, N. J.—The county commissions have voted to construct an iron bridge over Musconetcong creek at an estimated cost of $7,000.

Wausau, Wis.—The town of Easton has asked the county board for aid in construct ing a bridge across the Eau Claire river. Estimated cost, $3,000.

Breckenridge, Minn.—Sealed bids will be received until July 11 for the construction of a bridge across Otter Tail river. Z. T Sheperd, co. audt.

Mt. Vernon, O.—Bids are asked until July 6 for building the iron superstructures of two bridges over the Kokosing river. W. A. Wander, co. audt.

New Rockford, N. D.—Bids will be received until the July meeting of the county board for rebuilding the Monon bridge. F. S. Fun ham, co. audt.

Grafton, N. D.—Bids will be received until July 6 for constructing iron, combination and pile bridges during the year. O. M. Fraser, co. audt.

Birmingham, Ala.—Sealed proposals will be received until July 18 for constructing an iron bridge across Valley creek, near Brighton. Co. comrs.

New Orleans, La.—The residents of the Seventh ward have petitioned for the con struction of a bridge over the St. Bernard-ave. canal at Prieur-st.

Salem, S. D.—Bids will be received until July 9 for constructing a bridge in sec. 35 and two truss bridges, 36 ft. long. J. C. Headlee, co. audt.

Decatur, Ill.—The Wrought Iron Bridge company, Canton, O., has been awarded the contract for building a bridge over Stevens creek on the Mt. Pulaski road.

New Haven, Conn.—Plans have been completed by A. B. Hill, engr., for a new steel bridge at Lake Whitney, to be built by the New Haven County Club.

Clarion, Ia.—The board of supervisors visited Eagle Grove recently to examine the Wasem bridge, which they contemplate replacing with a steel bridge.

Mt. Vernon, O.—Bids are wanted until July 5 for constructing a 110 ft. bridge in Wayne

twp. and a 170-ft. bridge in Harrison twp. and a bridge in Clinton twp.

Brookings, S. D.—Bids will be received until July 13 for constructing a steel or combination bridge across the Sioux river, in Medary twp. J. T. Nelson, co. audt.

Assumption, Ill.—Press reports state that five small steel highway bridges will be built soon in Assumption twp. Charles A. Clark, H. H. Tripp and Mike Kirby, comrs.

San Jose, Cal.—Press reports say that County Supervisor Roll has been authorized to prepare plans for a steel bridge over Los Gatos creek, on Campbell-ave.

Rochester, N. Y.,—Bids are asked until July 5 for constructing a lift bridge over the Erie canal at Fitzhugh-st. Geo. W. Aldridge, supt. Pub. Wks., Albany.

Freeport, Ill.—The Wrought Iron Bridge company, Canton, O., secured the contract for building three bridges and repairing an old one in Buckeye twp. for $1,600.

St. Joseph, Mo.—Bids will be received July 7 for the construction of three bridges, repairs to a road and building an iron pipe culvert. Theo. Steinacker, co. surveyor.

Hamilton, O.—The bids received recently for building a hoist bridge across the Middletown canal were rejected, and new bids will be received July 15. Co. comrs.

Forman, N. D.—Bids, accompanied by plans and specifiactions, will be received until July 8 for constructing two bridges over Wild Rice creek. A. N. Carlblom, co. audt.

Santa Rosa, Cal.—Sealed bids will be received July 7 for constructing a bridge over Russian river, at Wall's Ford, in Redwood and Forestville districts. Somers B. Fulton, co. clk.

Bound Brook, N. J.—The freeholders of Somerset and Middlesex counties are reported as having decided upon the construction of a bridge over Green Brook, at Union-ave.

Cincinnati, O.—Sealed proposals will be received until July 15 for the construction of a wrought iron truss bridge over Taylor's creek, Miami twp. E. L. Lewis, co. audt.

South Bend, Ind.—A petition has been presented to the board of commissioners requesting the removal of the iron bridge across the St. Joseph river at Jefferson-st., and the erection of a new one.

Brooklyn, N. Y.—John L. Shea, bridge commissioner, has asked for an appropriation of $700,000 to build a new bridge over Newtown creek, from Manhattan-ave., Brooklyn, to Vernon-ave., Queens borough.

Denver, Col.—The residents in South and West Denver are anxious that the bridge now in line of the Fourteenth-st. viaduct, over the Platte river, be moved to the intersection of S. Fourteenth-st with Cherry creek.

Chicago, Ill.—Sealed proposals will be received until July 20 for supplying and erecting six bridge substructures and five superstructures along the line of the main drainage channel. Jas. Redding, clk. bd. drainage trustees.

Spokane, Wash.—Sealed bids will be received until July 5 for the construction of about 500 ft. of steel bridge and about 50 ft. of wooden trestle approach for carrying a water main across the Spokane river. B. H. Fowle, secy. B. P. W.

Jackson, Miss.—(Special.)—Walter G. Kirkpatrick, cy. engr., says plans are nearly ready for a steel bridge, 100 ft. wide and 86 ft. span, with buckled plate floors; for removing the present bridge (iron); for masonry abutments, and for alternate bids for an arch bridge of brick or Melan concrete.

Judge Garrison of the New York supreme court rendered a decision June 16, declaring that the removal of the former East river bridge commission and the appointment of the present commission by Mayor Van Wyck were illegal. The commissioners had recently secured an appropriation of $2,000,000 and were ready to advertise for proposals for constructing the towers and end spans, but the decision will prevent the making of further contracts.

PARKS.

Montpelier, Vt.—Plans have been prepared for a park. Joel Foster, cy. engr.

Santa Rosa, Cal.—Freeholder Ross advocates the establishment of a public park for this city.

Los Angeles, Cal.—The question of issuing $10,000 bonds for park purposes will be voted on July 5.

San Francisco, Cal.—The park commissioners are reported as having under consideration a plan for the improvement of Golden Gate park; estimated cost, $349,200.

Indianapolis, Ind.—The establishment of a park in the East End is proposed. The location of the park will be on E. Washington-st., and will lie between Washington, Randolph and Ohio-sts. and Johnson-ave. The plans for the White river park are about completed.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Westchester, Pa.—The question of purchasing an incinerator is being agitated.

Punxsatawney, Pa.—The question of erecting a garbage crematory is under consideration.

Lancaster, Va.—The purchase of a disposal plant, at about $8,000, has been prepared by Councilman Miller.

Columbus, O.—The sum of $20,000 has been authorized, according to press reports, for street cleaning.

Kenosha, Wis.—The contract for sprinkling Prairie-ave., was awarded, June 6, to J. H. O'Brien, at 12 cts. per lin. ft.

Hartford, Conn.—The contract for removing ashes, at $10,000 and garbage at $9,850 a year, was awarded to the Edward Balf company, June 1.

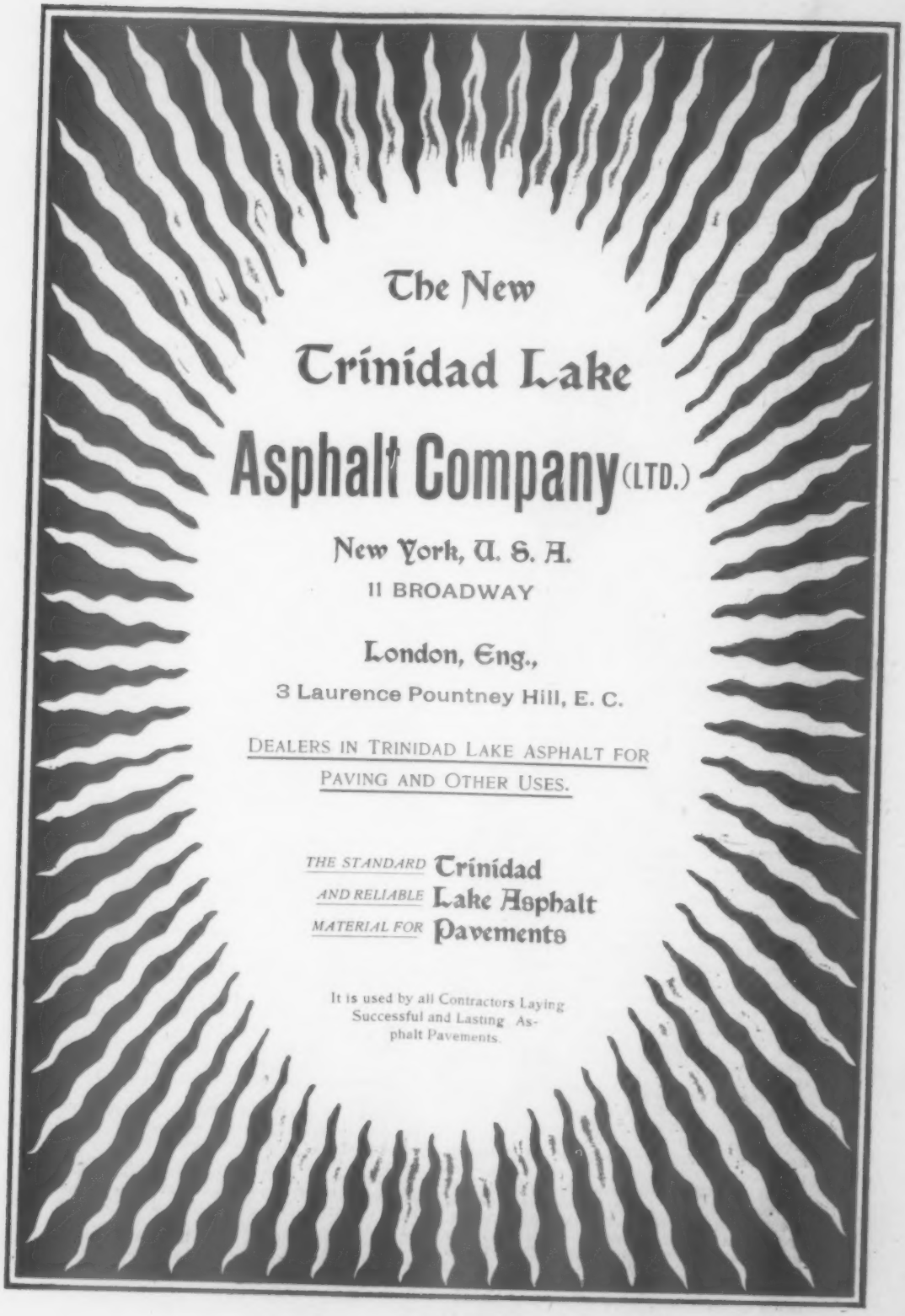
Almeda, Cal.—The council is considering the question of accepting a proposition from a company for a garbage disposal plant for this city.

Union Hill, N. J.—The contract for removing the garbage has been awarded, according to report, to Peter Brady, at $2,400 a year.

Hoboken, N. J.—A bid to remove the ashes and garbage of this city at $3,600 a year, has been submitted by Paul Breslau of Jersey City, N. J.

Plainfield, N. J.—A plan is being considered by which the city may acquire possession of the garbage plant of the Plainfield Sanitary company.

(Continued on page 29.)


The New
Trinidad Lake
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